December

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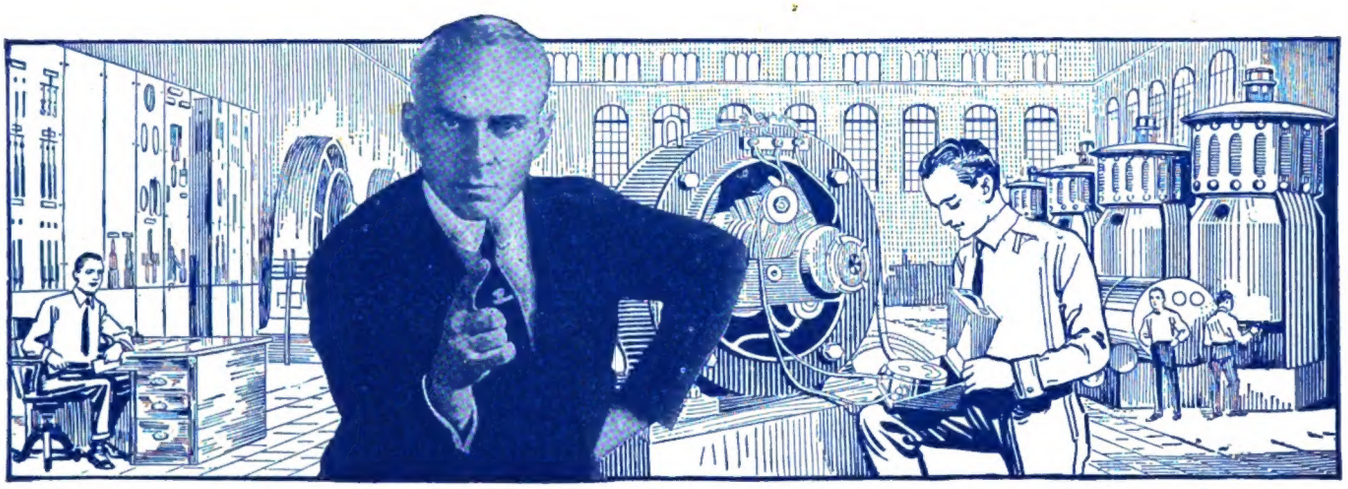

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Table of Contents for December

POPULAR SCIENTIFIC ARTICLES

EDITORIAL 737
THERMOCOUPLE FINDS ICEBERG 738
TEMPTRESSES OF DEATH 738
TAKING MOVIE SCENES IN MINIATURE 739
MOVIE DOUBLE EXPOSURE TRICK 740
SELF PROPELLING WAVE SHIP 741
STEREOSCOPIC MOTION PICTURES 741
DRIFTWOOD FINISH FOR CYPRESS 742
METHODS OF PRESERVING FLOWERS 743
NEW YORK'S PHOTO BY SEARCHLIGHT 744
By P. R. Bassett.
FAKE EARTHQUAKE MOVIES 745
By W. B. Arvin.
DR. HACKENSAW'S SECRETS—NO. 24. THE SECRET OF THE MEMORY OBLITERATOR 746
By Clement Fezandié.
AROUND THE UNIVERSE—SIXTH AND FINAL INSTALLMENT. 748
By Ray Cummings.
LARGEST VEHICULAR TUNNEL 750
By A. P. Peck.
INSECTS MAKE CAMERA DEBUT 751
By Edwin Schallert.
THE ANCIENT'S HOUSE HARDWARE 752
By Charles Beecher Bunnell.
INVISIBLE ELEVATED RAILWAY 753
By Edwin F. Linder.
MOORING MAST FOR DIRIGIBLE 754
FAMOUS OPINIONS ON SPIRITUALISM 755
FOSSILIZED EXTINCT ANIMALS 756
By Dr. W. A. Luz.
AIRPLANE LANDING STAGE 757
By George F. Paul.
THE WONDERS OF SATURN 758
By Isabel M. Lewis, M.A.
THE HEAVENS IN DECEMBER 760
By Isabel M. Lewis, M.A.
INVENTORS TRY IT ON THE LAWYER 761
SCIENTIFIC CHRISTMAS TOYS 762
MAGIC FOR EVERYBODY—NO. 9 OF A SERIES 763
By Professor Joseph Dunninger.
"KICK" PREVENTION FOR CIDER 764
By Raymond B. Wailes.
BURN YOURSELF? WHAT HAPPENS? 765
THE STARS IN 1,000 CENTURIES 766
By Donald H. Menzel.
SCIENTIFIC MATCH-BOX PUZZLES 767
SCIENTIFIC PROBLEMS AND PUZZLES 768
By Ernest K. Chapin.

PRIZE CONTESTS

WRINKLES, RECIPES, AND FORMULAS—$5.00 MONTHLY PRIZE 774
HOW-TO-MAKE-IT DEPARTMENT—$30.00 IN PRIZES 775
SCIENTIFIC HUMOR—PRIZE FOR BEST JOKES.. 788

AUTOMOBILES

TEMPTRESSES OF DEATH 738
LICENSE LOCK 765
ELECTRIC JACK 765
MOTOR DRIVEN SLED 766
MOTOR HINTS 814
By Tom C. Plumridge.

ELECTRICITY

THERMOCOUPLE FINDS ICEBERG 738
SELF PROPELLING WAVE SHIP 741
NEW YORK'S PHOTO BY SEARCHLIGHT 744
By P. R. Bassett.
SIMPLE BATTERY CHARGER FOR A.C. USE 770
By Dr. Ernest Bade.
HOW TO MAKE A STORAGE "A" BATTERY 773
LATEST PATENTS 787
ORACLE 789

RADIO ARTICLES

LOUD TALKER WITHOUT MICROPHONE 777
By Dr. Alfred Gradenwitz.
RADIO FOR THE BEGINNER—NO. 22. A RADIO CHRISTMAS 778
By Armstrong Perry.
BROADCAST STATIONS PHOTOGRAPHS 779, 780
THE COMPACT "SINGLE SIX" CIRCUIT 781
By H. E. Hayden.
MULTI-WAVE REINARTZ RECEIVER 782
By Kenneth Harkness.
HOW TO BUILD A ROGER'S CAGE LOOP 783
WELL MADE RADIO CABINET 784
RADIO ORACLE 785
BROADCASTING STATIONS CALL LETTERS UP-TO-DATE 802
RADIO WRINKLES—Edited by A. P. Peck 822

CONSTRUCTOR ARTICLES

SIMPLE BATTERY CHARGER FOR A.C. USE 770
By Dr. Ernest Bade.
"BOBCAT," AN AIR PROPELLED SLED 771
By G. A. Luers.
COMBINATION DRILL AND LATHE 772
HOW TO MAKE A STORAGE "A" BATTERY 773
By Dr. Ernest Bade.

CHEMISTRY ARTICLES

"KICK" PREVENTION FOR CIDER 764
EVERYDAY CHEMISTRY 769
By Raymond B. Wailes.
CAPTURING FROST CRYSTAL FORMS 774
By S. Leonard Bastin.

ASTRONOMY ARTICLES

THE HEAVENS IN DECEMBER 760
By Isabel M. Lewis, M.A.
THE STARS IN 1,000 CENTURIES 766
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Founder of Famous Merke Institute, Fifth Avenue, New York

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Not One Penny's Risk!

Now I realize that you have perhaps wasted a lot of time and money on treatments which could NEVER restore your hair. Very likely you are skeptical. All right. I don't blame you. And I'll admit right here that my treatment may not help you either. For your case may be one of the three in every hundred that is absolutely hopeless. In any case, I want you to try my treatment at my risk—and if after 30 days you are not more than delighted with the results produced—then all you need do is tell me so, and without asking a single question I'll mail you a check refunding every cent you have paid me. I don't want a cent of your money, unless I *actually grow hair on your head!* You of course, are to be the sole judge.

Actual Results

(Dozens of letters like the following are received every day by the Merke Institute.)

"In the short time I have used your treatment I have gained remarkable results. Dandruff has disappeared entirely. My scalp is now all full of fine new hair. I would not part with my treatment for 10 times its cost." A. W. B.

"The top of my head is now almost covered with new hair about one-half inch long. I have been trying five years, but could never find anything to make my hair grow until your treatment." T. C.

"Ten years ago my hair started falling. I used hair tonics constantly, but four years ago I displayed a perfect full moon. I tried everything—but without results. Today, however, thanks to your treatment, I am pleased to inform you that I have quite a new crop of hair one inch long. My friends are astonished at the result." F. H. B.

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My treatment proves that a big percentage of baldness is caused—not by *dead* hair roots—but by *dormant* hair roots, which can now be awakened and made to grow hair again. The reason other treatments failed is because they did not penetrate to these dormant roots. To make a tree grow, you would not think of rubbing "growing fluid" on the bark. Instead you would get right to the roots. And so it is with the hair.

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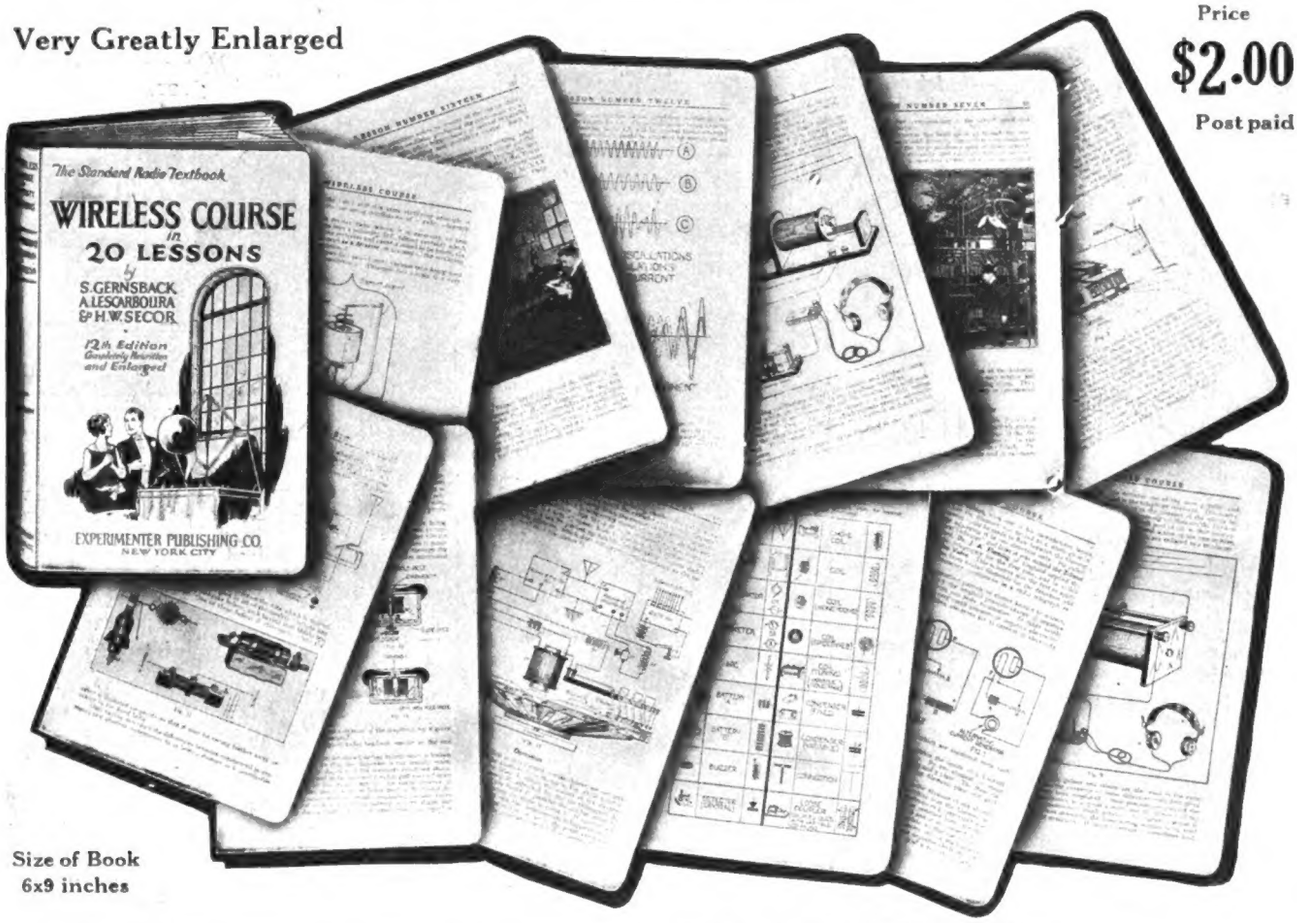

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How to Invent— What to Invent

and What to Do About Protecting and Selling An Invention

ALTHOUGH the fact has been universally recognized that Invention is governed by a few simple, easily acquired, fundamental principles, no one ever thought of putting these principles in black and white so that everybody interested in invention could read them. In spite of the fact that Thomas A. Edison made his famous statement that invention should be taught as a science, thousands of people continued to work blindly, doggedly, haphazardly to perfect their ideas.

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Suppose when you went home tonight, you found a window rattling. Through your mind would flash, almost instinctively, a regular order of thoughts which characterize the conception and completion of every invention the world has ever known. First, you would recognize a problem to be solved—the rattling of the window. Then you would think of several principles of science or mechanics which would solve your problem. You might think of the scientific fact that if you poured water on the frame the wood would swell and tighten the window. You might think of using a nail. But what you most probably would do would be to use the oldest mechanical principle known to man, the wedge.

What Invention Is

Brought down to its simplest terms, that is exactly the way every invention has been made—combining two ideas; a problem which must be solved and a fact of mechanics or science which solves the problem. So, although you may never have thought of it in just this way every time you solve a problem in your daily life—at home, traveling, or in business—you are an inventor; you use the principles of thought and action which govern the Science of Invention!

You can see, therefore, how easy it is for you to develop your natural instinct to "fix things." The same processes of thought that almost instinctively told you to fix a rattling window with a wedge can be so well developed that you can learn to invent other things almost as easily and quickly. You know, too, that every invention is made only by thinking inventively. And every inventor is agreed that the principles of Inventive Science are so simple, so easy to learn that any one, regardless of training or education, can develop himself to become a successful inventor!

With every new advance, with every new discovery that the world experiences, more problems are coming up—and more inventions are needed to solve these problems. Now, as never before, are new inventions wanted, and the world will pay a fortune to the man or woman who gives it just one of the inventions it needs.

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Learn how to invent at home

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SUPER 180° VARIOCOUPLER

G521 Each 98c
A wonderful value, produces excellent results. Green silk windings on black fibre tubes. Rigid mounting support for table or panel mounting. Primary tapped for fine tuning. ¼ inch shaft. Range 200 to 600 meters.

G522 Variometer—same style. Each...98c

SUPERIOR VARIOCOUPLER

G523 Each.....$3.15
A handsome instrument of superior design and construction. Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. Table or panel mounting. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.

G526 Special single circuit type.....$3.60

SUPER MOULDED VARIOMETER

G412 Each.....$2.60
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

EXCEL MOULDED VARIOMETER

G524 Each.....$3.68
A wonderful value at our price. Properly designed and constructed. Polished black bakelite rotor and stator forms. large size. Green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Table or panel mounting.

SUPERIOR VARIOMETER

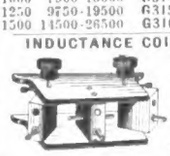
G525 Each.....$4.45
Forms moulded of red brown bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Table or panel mounting. Produces superior results in any type circuit 180 to 650 meters.

RADIO INDUCTANCE COILS

Carefully made — fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance — high self inductance. Very firm impregnation. Range given is in meters when used with .001 variable condenser. Mounted coils have standard plug mountings.

Turns	Range	Art. No.	Net Mntd.	Art. No.	Price Mntd.
25	120- 250	G301	$0.39	G320	$0.80
35	175- 450	G302	.42	G322	.94
50	240- 720	G303	.49	G323	1.00
75	390- 910	G304	.54	G324	1.06
100	500- 1450	G305	.58	G325	1.11
150	600- 2000	G306	.63	G326	1.15
200	900- 2500	G307	.72	G327	1.24
250	1200- 3500	G308	.78	G328	1.33
300	1500- 4500	G309	.82	G329	1.34
400	2000- 5000	G310	.97	G330	1.55
500	2800- 6100	G311	1.12	G331	1.69
600	4000-10000	G312	1.27	G332	1.75
750	5000-12000	G313	1.43	G333	1.99
1000	7900-15000	G314	1.70	G334	2.25
1250	9750-19500	G315	1.92	G335	2.40
1500	14500-26500	G316	2.18	G336	2.55

INDUCTANCE COIL MOUNTINGS



G340—3 Coil. Ea. $3.40
G341—2 Coil. Ea. 2.75
Sturdy, rigid durable construction. Made of polished black bakelite. Mount on front of panel.

BACK OF PANEL MOUNTING

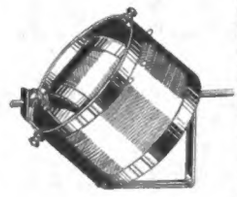
Mounts back of panel, with knobs or dials on front of panel. Helps make a most efficient set.

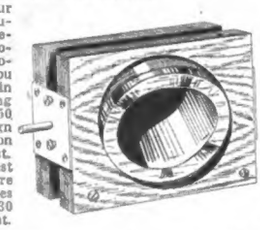
G342—3 Coil Back of Panel Mounting $4.45

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
G248 100 ft. coil 58c G249 500 ft. coil $2.75

OUR SPECIAL VARIOMETER AND VARIOCOUPLER





Build into your set reliable instruments. You can depend on this variometer and variocoupler to give you the best results in any circuit working from 180 to 650 meters. In design and construction they are the best. Only the highest grade materials are used. The prices quoted save you 30 to 40 per cent. Why pay more?

G418 Variocoupler. Each.....$2.45
The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Handsome green silk windings. Primary tapped for fine tuning. Can be panel or table mounted. ¼ inch shaft.

G410 Variometer. Each.....$2.10
Perfect in design and construction. Accurate wood forms thoroughly seasoned. Correct inductive ratios. Solid baked windings. Plenty of large sized wire insures highest efficiency. A strong high grade instrument that will give you lasting service. ¼ inch shaft.

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated.

DoubleCotton Covered		Enameled Insulation		Green Silk Covered	
Number	G990	Number	G992	Number	G991
Gauge	Price	Gauge	Price	Gauge	Price
18	.43c	20	.39c	20	$0.78
20	.55c	22	.50c	22	.95
22	.70c	24	.55c	24	1.10
24	.80c	26	.60c	26	1.38
26	.90c	30	.65c	30 (4 oz.)	1.25
28	$1.05	32	.70c	32 (4 oz.)	1.85
30	1.45	36	.90c	36 (4 oz.)	2.20

ANTENNA INSULATORS

G260

G260 Size 1x3¼. Composition, metal eyelets. Two for 17c
G264 Size 1½ x 4. For medium size aerials. Two for 69c

G234-5

G266 Size 1½ x 10½. For large aerials. Two for .$1.28
G213 Ribbed Porcelain insulator. 2½ in. long. Ea. 6c Dozen 55c

LEAD-IN INSULATORS

G270 For 4 inch walls or less.....42c
G271 For 9 inch walls or less.....69c
The only practical lead in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER

G980 Price $1.55
Protect your instruments with this lightning arrester. Weatherproof porcelain case. Air gap type. Permanent. Durable. Underwriters approved.

HIGH-GRADE LIGHTNING ARRESTER

G981 Each 79c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

SPIDER WEB COILS

G290 25 turn. Each.....39c
G291— 35 turn. Each.....42c
G292— 50 turn. Each.....47c
G293— 75 turn. Each.....54c
G294—100 turn. Each.....59c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with fibre mounting strips.

COIL MOUNTING PLUGS

Made of genuine bakelite.
G344 Plug for mounting "honeycomb" inductance coils 39c
G345 Stationary plug to fasten mounted coil stationary to panel 42c
G346 Movable plug to fasten mounted coil to panel so it can be rotated.....89c
G343 Fibre strip to hold coils for mounting. Two foot piece 15c

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.
G240 100 ft. coil 48c G242 500 ft. coil $2.25

Solid Bare Copper Wire, size 12.
G244 100 ft. coil 67c G245 500ft. coil $3.05

REINARTZ INDUCTANCE

G296 Each.....$1.15
Made of green silk covered wire, spider-web wound to produce greatest efficiency and lowest losses. 21 taps so arranged that crossing is avoided. Two fibre strips and wooden rod furnished permit various styles of mounting. With this coil a high grade set can be built at a low cost. Directions included

RADIO SOLDERING IRON

G540...$1.50
Soldered connections in radio sets produce better results. This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches. Heats quickly will not overheat.

Heavier irons for general repair work. Wonderful values at our prices.

G541 Medium size.....$3.48
G542 Larger size 4.25

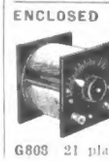
AUTOMATIC BLOW TORCH

G543 Each $1.19
Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high, ⅞ inch diameter cylinders. Works fine with Tinol listed below.

SUPER BLOW TORCH

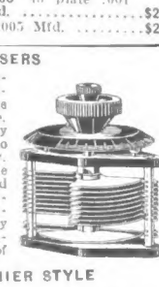
G544 Each 39c
Burns denatured alcohol. Vest pocket size. Blowing on tube produces a hot pointed flame. Lights with a match. Works fast. Burns 10 minutes on one filling. Easy to solder joints in hard places. 3 in. high. ⅞ in. cylinder. Long rubber tube. Produces fine joints with Tinol listed below.

ENCLOSED VARIABLE CONDENSERS



One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer. Clear transparent case.
G806 43 plate .001 Mfd. $2.80
G803 21 plate .0005 Mfd. $2.45

PANEL MOUNTING VARIABLE CONDENSERS



These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning.

REGULAR STYLE

G815— 3 plate 58c
G816— 7 plate 97c
G814—11 plate .00025 mfd. $1.28
G813—21 plate .0005 mfd. 1.35
G812—43 plate .001 mfd. 1.58

VERNIER STYLE

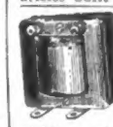
Including Dial and Knobs

G825—11 plate .00025 mfd. $2.45
G824—26 plate .0005 mfd. 2.75
G826—36 plate .001 mfd. 3.15

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

G550 Each $2.25
The result of years of research work and experienced engineering. In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. 5 to 1 ratio. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect. Not to be compared with articles built for price only.

OUR SPECIAL SHIELDED TRANSFORMER



G551—3½ to 1 Ratio. Each $2.55
G552—6 to 1 Ratio. Each 2.75
The same high grade style of transformer as above enclosed in a metal case which completely shields it from any outside magnetic influences. Very attractive appearance and sturdy construction. Free from howling and local disturbances.

THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

G232 Ratio 3½ to 1 $3.40
G233 Ratio 6 to 1 $3.80
Recognized by leading radio engineers as the best balanced and most efficient transformer. Correct characteristics for any standard tube. Wonderful results without distortion on one, two or three steps. Plainly marked binding post connections on bakelite panel.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.
G553 Acme. Each $4.45
G554 Coto. Each 4.45
G555 Federal. Each 4.45
G712 Radio Corp. Each..... 6.40
G234 All American 10 to 1 Shielded 4.15
G239 All American 5 to 1 Shielded 4.10
G236 All American 3 to 1 Shielded 3.95

RADIO FREQUENCY AMPLIFYING TRANSFORMER

G560 For 201A or 301A Tubes $1.70
G561 For 199 or 11 or 12 Tubes $1.70
Due to its special design this transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. While low in price we believe it equal or superior to higher priced transformers. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters. Try it. If you are not satisfied return it and get your money back.

OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

G568 Our special—as good as any of them .....$ .48
G562 Dubilier. Each..... 4.45
G563 Coto. Each 4.45
G564 Rasla. Each 4.45
G565 Acme. First stage. Each..... 4.45
G566 Acme. Second stage. Each.... 4.45
G567 Acme. Third stage. Each..... 4.45
G714 Radio Corp. Each..... 5.95
G995 All American. Each..... 3.95
G575 Erla. First stage. Each..... 3.55
G576 Erla. Second stage. Each..... 3.55
G577 Erla. Third stage. Each..... 3.55
G578 Erla. Reflex. Each..... 4.45

NEUTRALIZING CONDENSERS

G572 Per set of two.....40c
Simple, inexpensive, effective precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

SPECIAL

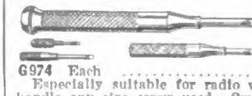
G573 Neutrodyne Jack. Each.....89c

LONG NOSE PLIERS

G970 Price...95c
The handiest pliers for radio work. Made of fine hardened steel. Length, 5 in.

DIAGONAL JAW NIPPERS

G972 Price ...$1.05
For fine electrical work, made of hardened steel. Length, 5 inches.



FOUR-IN-ONE Screw-Driver

G974 Each 55c
Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.

TINOL

G969 Per tube...19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal St., Chicago, Ill.

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WITH BARAWIK STANDARD RADIO GOODS

WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES

PRESERVE THESE PAGES — ORDER FROM THEM AND SAVE MONEY
FAST SERVICE — TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

G105 Detector, UV200 C300 Each $4.38
G112 Amplifier, UV201A C301A, ... 5.85
G118 5 Watt Transmitter.. 7.70
G107 WD11 C11. Each.... 5.85
G101 WD12 C12. Each.... 5.85
G102 UV199 C299. Each..... 5.85
G104 UV199 Adapter fits 199 tube to standard socket ..... .42
G108 WD11 Socket. Each..... .31
G109 WD11 Adapter. Each..... .45

STANDARD TUBE SOCKET

G140 Each 39c
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

METAL TUBE SOCKET

G146 Each 39c
A strong durable socket for panel or table mounting. Metal tube and base. Plainly marked binding post connections well insulated.

TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact workmanlike job. Perfectly made of high grade materials. Quickly mounted on panel or base.

G147 Two-gang socket 95c
G149 Three-gang socket $1.30

199 SOCKET

G145 Each 49c
Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

FILAMENT CONTROL RHEOSTATS

G132 6 ohm. Each.....45c
G129 20 ohm. Each....52c
G131 30 ohm. Each....59c
G135 6 ohm Vernier...95c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2½ in. Tapered polished black knob 1¼" diam.

Potentiometers. Match above rheostats. Same high grade construction.

G151 200 ohm. Each.....79c
G152 400 ohm. Each.....79c

SUPERIOR RHEOSTATS

G153 6 ohm. Each.....69c
G154 20 ohm. Each.....76c
G155 30 ohm. Each.....83c
The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.

Potentiometers to match above rheostats with dial and knob.

G156 375 ohm 98c

QUICK ACTING RHEOSTAT

G124 6 ohm. Ea.....79c
G125 15 ohm. Ea....88c
G126 30 ohm. Ea....99c
Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.

THREE INCH DIAL

G923 For 3-16 inch shaft. Each 22c
G924 For ¼ inch shaft. Each 22c
A handsome neat looking dial moulded in one piece of polished black composition. 180° scale marked 0 to 100 finely engraved in contrasting white enamel. Diameter 3 inches.

TWO INCH DIAL

G921 For 3-16 inch shaft. Each 16c
G922 For ¼ inch shaft. Each 16c
A handsome dial moulded in one piece of polished black composition. 270° scale marked 0 to 100 finely engraved in contrasting white enamel. Fine for rheostat or switch control. Diam. 2 in.

VERNIER DIAL ADJUSTER

G941 Each 19c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

SUPERIOR RADIO JACKS

Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ¼ to ⅜ in.

G390 Open circuit. Each.....36c
G391 Closed circuit. Each.....45c
G392 Two circuit. Each.....54c
G393 Single circuit filament cont....58c
G394 Two circuit filament cont.....74c

BAKELITE DIALS

G931—2 in. Diam. for 3-16 in. shaft. Each 35c
G932—2 in. Diam. for ¼ in. shaft. Each....35c
G933—3 in. Diam. for 3-16 in. shaft. Each..39c
G934—3 in. Diam. for ¼ in. shaft. Each...39c
G935—4 in. Diam for ¼ in. shaft. Ea. 43c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Sizes match perfectly.

ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.

G730 Each 89c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.

G732 Each 59c

GREWOL CRYSTAL DETECTOR

G742 Each $1.69

DETECTOR CRYSTAL CAREFULLY TESTED

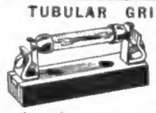
G736 Galena, Arlington tested, piece 19c
G738 Silicon, Arlington tested, piece 19c
G735 Tested, Galena, Mounted, piece 9c
G737 Tested, Silicon, per piece..... 9c
G739 Genuine million point crystal. Ea.29c

SUPERIOR VARIABLE GRID RESISTANCE

G167 Each 80c
G168 With .00025 Condenser 95c
Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

G171 Freshman panel mounting variable grid leak with .00025 condenser. Each 69c
G172 Durham variable grid leak with mounting. Each 89c
G173 CRL Variable grid leak. Each $1.19

TUBULAR GRID LEAKS AND CONDENSERS



Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.

G849 Grid Leak. Each.....18c
Resistances—½, 1, 1½, 2, 3, 5, 7, and 10 megohms. Specify which size is wanted.

G831 Grid and Plate Condensers. Ea. 39c
Capacities—.00025, .0001, .00025, .0005 mfd. Specify which size is wanted.

Mountings. Bakelite base.
G840 Single mounting. Each.....28c
G842 Double mounting. Each.....47c
G844 Triple mounting. Each.....67c

VARIABLE GRID LEAKS

G160 Standard style...15c
G161 De Luxe style with extra heavy screw top finely finished 32c
Pencil mark type for panel mounting. Resistance may be varied exactly as needed.

GRID CONDENSERS

G162 Well insulated. Paper covering. Each.....7c
G163 Highest grade. Mica insulated. Polished nickel case. Each 23c
Fit over posts of above leaks. The combination makes an efficient unit. Cap. .00025 mfd.

STANDARD BRAND LOUD SPEAKERS AND UNITS

G610 Murdock $4.38
G611 Rico 4.85
G613 Barawik with Baldwin unit... 9.95
G615 Pathe 16.50
G616 Atlas 19.50
G612 Magnavox R3 .....32.50
G614 Magnavox M1.....32.50
G617 Music Master 27.00
G755 Genuine Baldwin type C Unit 5.35
G619 Barawik Special Unit..... 2.60

COMPETITOR JACKS

G387 Open circuit. Each.....27c
G388 Two circuit. Each.....35c
Well made, durable, smooth working, nickel finished frame. Well insulated.

SUPERIOR RADIO PLUGS

G395 With set screws for fastening cord. Each ...35c
G397 Two-way — takes two pair any style cords. Each.....59c
Highest grade plugs. Fit any standard jacks. Polished round barrels.

SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.
Dozen 15c **Hundred $1.00**
Order by Article Number.
G360 Head, ¼" diam.; ⅛" high
G362 Head, 3-16" diam.; ⅛" high
G363 Head, 3-16" diam.; 1-16" high

Solder Lugs to Fit Contact Points
Also for connecting wires to binding posts, etc.

G365 **Dozen 8c** **Hundred 30c**

SWITCH LEVER STOP

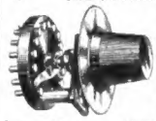
Brass polished nickel finish.
G386 **Dozen 18c** **Hundred $1.05**

SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.

G381 1¼" Radius. Ea. 15c

INDUCTANCE SWITCH



G385 Price including knob and dial..$1.29
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used. Smooth wiping contacts. Attractive tapered knob.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.
G370 Large size—barrel and knob ¾" long. Dozen 85c
G372 Smaller size — barrel and knob 9-16" long. Dozen.....70c
G370-2-4

G376-8

G374 Large size with composition knob. Dozen 45c
G376 Large size with hole for phone tip or wire. Dozen.....80c
G378 Smal size with hole for phone tip or wire. Dozen.....35c

BARAWIK QUALITY HEADSETS

G770 Per Set, 2000 ohms.....$3.25
These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

STANDARD BRAND HEADSETS

G754 Baldwin Type C with universal jack plug $11.75
G756 Red Head, 3000 ohm 5.78
G768 Brandes, 2000 ohm 5.35
G769 Brandes, 3000 ohm 6.90
G751 Murdock 56, 2000 ohm $3.59
G752 Murdock 56, 3000 ohm 3.95
G764 Frost, 2000 ohm 3.59
G766 Frost, 3000 ohm 4.15
G758 Western Electric 9.50

SUPERIOR INDUCTANCE SWITCH

G384 Each 74c
Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier. Metal parts nickeled. Bakelite knob and supporting base.

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.

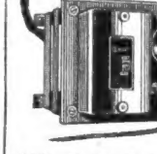
G180 Signal Corps type, small size. 15 cells, 22½ volts. Each $1.10
G182 Large size, 5 taps 16½, 18, 19½, 21 and 22 volts. Each.....$1.59
G184 Variable Large Navy size, 16½x14x7 inches 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each..$1.95
G188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Ea. $3.65

STORAGE "A" BATTERY

A very high grade battery made especially for radio service. Guaranteed for three years. Properly cared for will give many more years of service for filament lighting. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.

G194 6 volt, 40 ampere size. Each $10.75
G196 6 volt, 80 ampere size. Each 13.25

HOMECHARGER BATTERY CHARGING RECTIFIER



Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

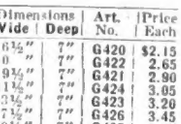
G201 For 6 volt battery.....$12 95
G203 For 12 volt battery..... 12 95

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite, Condensite Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled.

Panel Size Inches	⅛" thick Art. No.	Price	3-16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	G450	$0.57	G460	$0.86	G470	$1.15
6x10½	G451	.86	G461	1.27	G471	1.73
7x14	G458	1.38	G468	2.07	G478	2.76
7x18	G453	1.78	G463	2.65	G473	3.56
7x21	G457	2.05	G467	3.05	G477	5.10
7x24	G459	2.42	G469	3.56		
9x14	G454	1.85	G464	2.65	G474	3.56
12x14	G455	2.42	G465	3.56	G475	4.78
12x21	G456	3.62	G466	5.35	G476	7.13

CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5½"	6½"	7"	G420	$2.15
6x10½"	5½"	10 "	7"	G422	2.65
7x10"	6½"	9¾"	7"	G421	2.90
7x12"	6½"	11½"	7"	G424	3.05
7x14"	6½"	13½"	7"	G423	3.20
7x18"	6½"	17½"	7"	G426	3.45
7x21"	6½"	20½"	7"	G425	3.85
7x24"	6½"	23½"	7"	G429	4.65
9x14"	8½"	13½"	10"	G428	3.55
12x14"	11½"	13½"	10"	G430	4.65
12x21"	11½"	20½"	10"	G432	5.45

THE BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal St., Chicago, Ill

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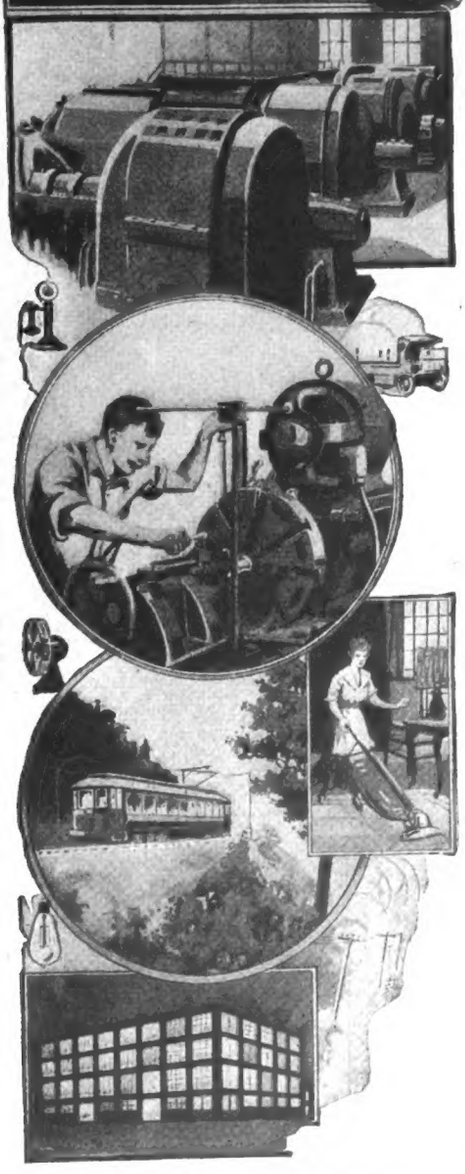

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Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

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Volume XI
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Science and Invention

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1923
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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact"--HUXLEY

Inventions Wanted

By H. GERNSBACK

WE have in the past mentioned editorially in these columns that great fortunes have been made in a great number of cases from simple ideas correctly worked out. The more complicated our lives become the more we are in need of simple devices; particularly those inventions that make things easier and simpler for us are in big demand. The fountain pen, the clutch pencil, the book-match, and dozens of others, not only have made fortunes for the owners of the patents, but are making fortunes right now in their further exploitation.

I BELIEVE

¶ THAT we should generate power while the sun shines.

But what is to be invented? What ideas are to be worked out? The answer and the recipe are rather simple. Any inanimate objects that constantly annoy you, will annoy a million more like yourself. The annoying objects obviously have not been properly designed and other better ones might easily take their places. It is not only inanimate objects that annoy us but certain conditions arise continuously which make things uncomfortable for us, when people will gladly spend money to do away with the discomfort. What is meant by this is explained in the suggestions below.

WINDOW CLOSER. When a clever American invented the American window he hit upon a whale of an idea. In Europe, and before the American window was invented, there were no two separate window frames sliding vertically—instead they use in Europe even now—two frames that meet in the center and open like doors, sideways. The American window is a wonderful invention. It has been perfected to such an extent that a slight touch of the hand will raise or lower it, due to the counterweights. What the window, however, does not do is to close itself when it starts raining or snowing. A simple invention which mechanically would open a trip the moment it starts raining or snowing when the house owner is away or in bed asleep, would probably be adopted all over the country.

I BELIEVE

¶ THAT in radio, we have not even scratched the surface as yet. Radio's greatest wonders are still to come.

ICE-WATER GLASS. The doctors tell us that one of the reasons why we are all becoming more and more dyspeptic is that we Americans swallow ice water in huge quantities. Cold water is all right but ice water with its microbes and other impurities from the ice are obviously not good for us. Everybody uses ice water and we all know that it is harmful. What is wanted is a glass formed in such a shape that the ice will cool the water without coming into contact with it. The glass should be simple and inexpensive and not too complicated. Neither should it be a freak. One of these days such a glass will make its appearance and will net its inventor a fortune.

DINING CAR INDICATOR. If you travel much about the country and have occasion to eat in dining cars, you will often find yourself huddled up with dozens of other travelers somewhere in the corridor of the dining car; the reason being that the diner seats only so many people and you have to await your turn. Suppose an electrical or a mechanical device were installed at the end of each of the coaches throughout the train. Let us say that a red color appearing in a box would mean that the diner is full, while green would mean that seats are to be had. Such a device if it can be made right would do away with the present nuisance of keeping men, women and children waiting, sometimes for hours, standing in the corridors of the dining car.

AUTO CAR HEATER. Driving in the winter is one of the best pastimes we have. When it is very cold, extended trips out into country become uncomfortable as our feet and legs become extremely cold. What is needed is a cheap auto heater. To be sure, there are a number of these on the market today, particularly the ones that work from the exhaust of the car. They are, however, not very easy to install. A mechanical, electric, or chemical car heater that need not be attached to the exhaust pipe and can be sold for a few dollars would soon find twenty million customers. The device must be simple to operate and must not be messy, and the heat should be reasonably inexpensive.

I BELIEVE

¶ THAT an idea well worked out is worth three ideas patented in a hurry.

BOTTLE CAP. The present steel bottle cap was a wonderful invention. It has just one fault. It requires some sort of a tool to open the bottle, and very often just when you want to open it most you are not able to find a bottle-opener. The milk people have solved the problem by using paraffine cardboard disks which serve very nicely for milk. But they will not do for ginger ale or other charged liquids. There must be some way to produce a bottle cap that can be opened, using nothing but your hands. We are all waiting for it and are willing to pay the inventor a fortune for the idea.

SUGAR DISPENSER. Every time you go into a restaurant, particularly the popular price ones, you will find a bowl of sugar with a spoon. Like as not, the customer preceding you has been careless, having put the spoon into his coffee, or milk, or what not, and let its contents drip all over the sugar. This does not look very appetizing to you when your turn to use it comes. Also flies that are holding mass meetings around the sugar bowl in the summer are not welcomed enthusiastically, nor are they desired. Some mechanical sugar bowl without a spoon, which is normally closed hermetically, is badly needed. It can be made so that at the touch of the hand or by turning the bowl otherwise, just one spoonful of sugar will be dispensed. Such a device will find its way into every restaurant and every home, if it can be made cheaply.

SALT SHAKER. The world is still waiting for a salt shaker that you do not feel like throwing out of the window in rightful wrath every time you use it. To be sure, there is a whole carload of patents on salt shakers, but somehow either the inventors were lax or the devices were impractical because we are still using the old timer which we shake hard but which refuses obstinately to give us salt. One of these days a genius will tackle the problem in an entirely different manner and his invention will give us salt when we want it without strenuous exercise and without the caking of the salt.

Powdered salt which will "shake out" of a salt-shaker is necessarily dry salt. Cannot a salt-shaker be devised which will keep salt dry and powdery in the dampest weather? Even the aspect of the dry, floury condiment is more appetizing than lumps of damp material, which will not yield to distribution. And when occupied with a salt-shaker do not forget the pepper castor which also clogs up.

THE GOLDEN AGE OF SCIENCE

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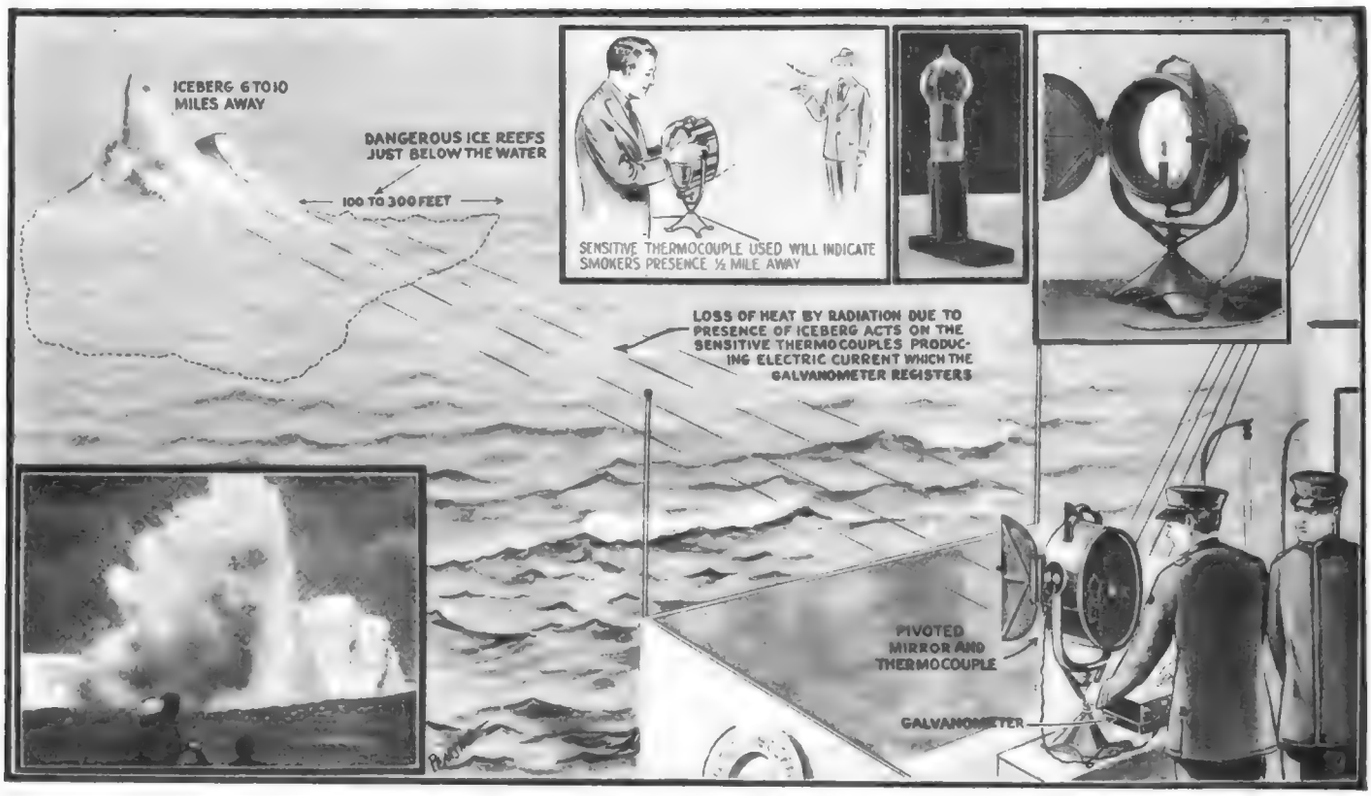
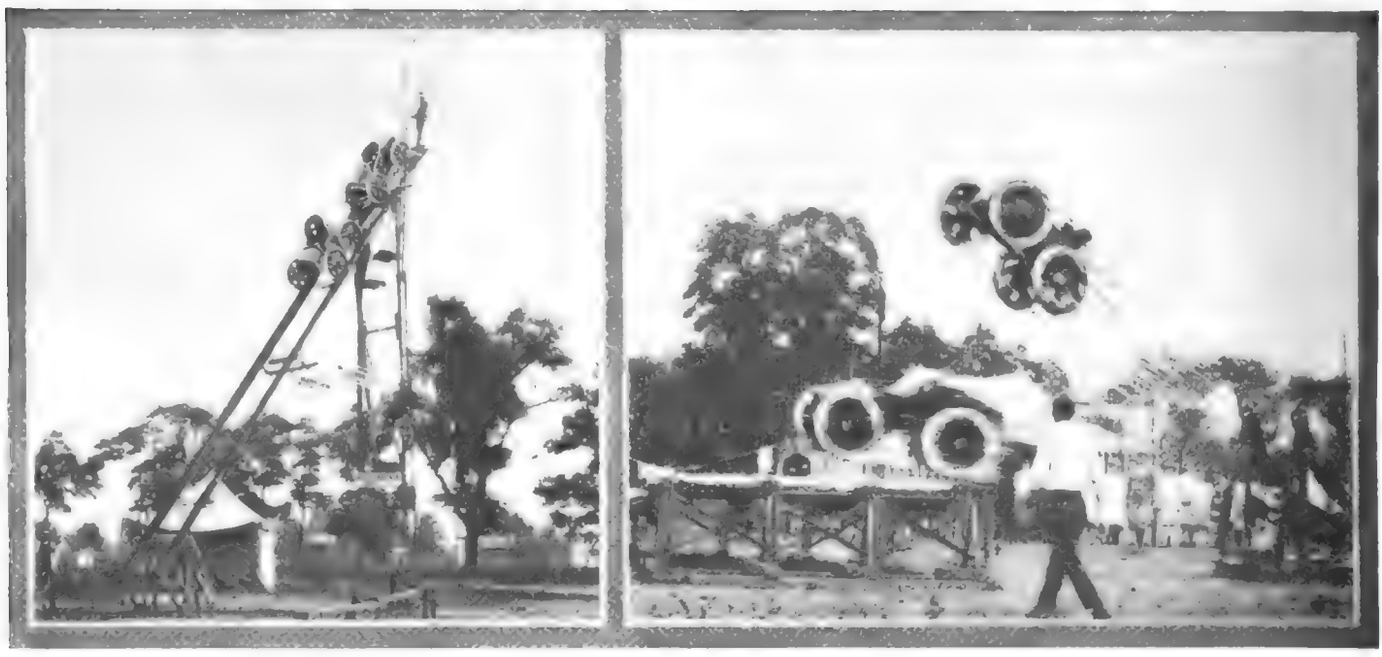
Thermocouple Finds Iceberg


ICEBERG 6 TO 10 MILES AWAY
DANGEROUS ICE REEFS JUST BELOW THE WATER
100 TO 300 FEET
SENSITIVE THERMOCOUPLE USED WILL INDICATE SMOKERS PRESENCE ½ MILE AWAY
LOSS OF HEAT BY RADIATION DUE TO PRESENCE OF ICEBERG ACTS ON THE SENSITIVE THERMOCOUPLES PRODUCING ELECTRIC CURRENT WHICH THE GALVANOMETER REGISTERS
PIVOTED MIRROR AND THERMOCOUPLE
GALVANOMETER

The thermocouple, encased in a vacuum tube, shown in the top inset, is placed in front of a mirror in a searchlight-like case; it is so sensitive that galvanometer readings will indicate changes in temperature so accurately that the presence of an iceberg can be located by it at a distance of ten miles. The instrument is manufactured by Carl Zeiss, Jena. The mirror is silvered on the front side so the glass will not absorb any of the heat.

Temptresses of Death



By driving the cars down the incline at 130 miles an hour, Sisters Betty and Peggy Gregg, speedway drivers, give spectators the thrill of a lifetime. The cars are of different gages. One takes the heavy curve at the bottom of the incline with the result that it loops-the-loop three times in the air. The other, which starts afterwards, takes a lighter curve and so shoots out onto the runway under the looping car.

This is an invitation. SCIENCE AND INVENTION has $1,000 which it is going to use, beginning with the January issue (and every month for a year) for relief work—relief of the mechanical and observant brain. You see something, you have an idea, you know a friend who has a novel device. You are, of course, very anxious to tell the world about it. Well, SCIENCE AND INVENTION, will relieve you of your idea, and if it conforms to the editorial policy will send you a handsome new check, perfectly signed and endorsed as one of the prizes it is offering for articles, pictures and sketches. For details see page 754.

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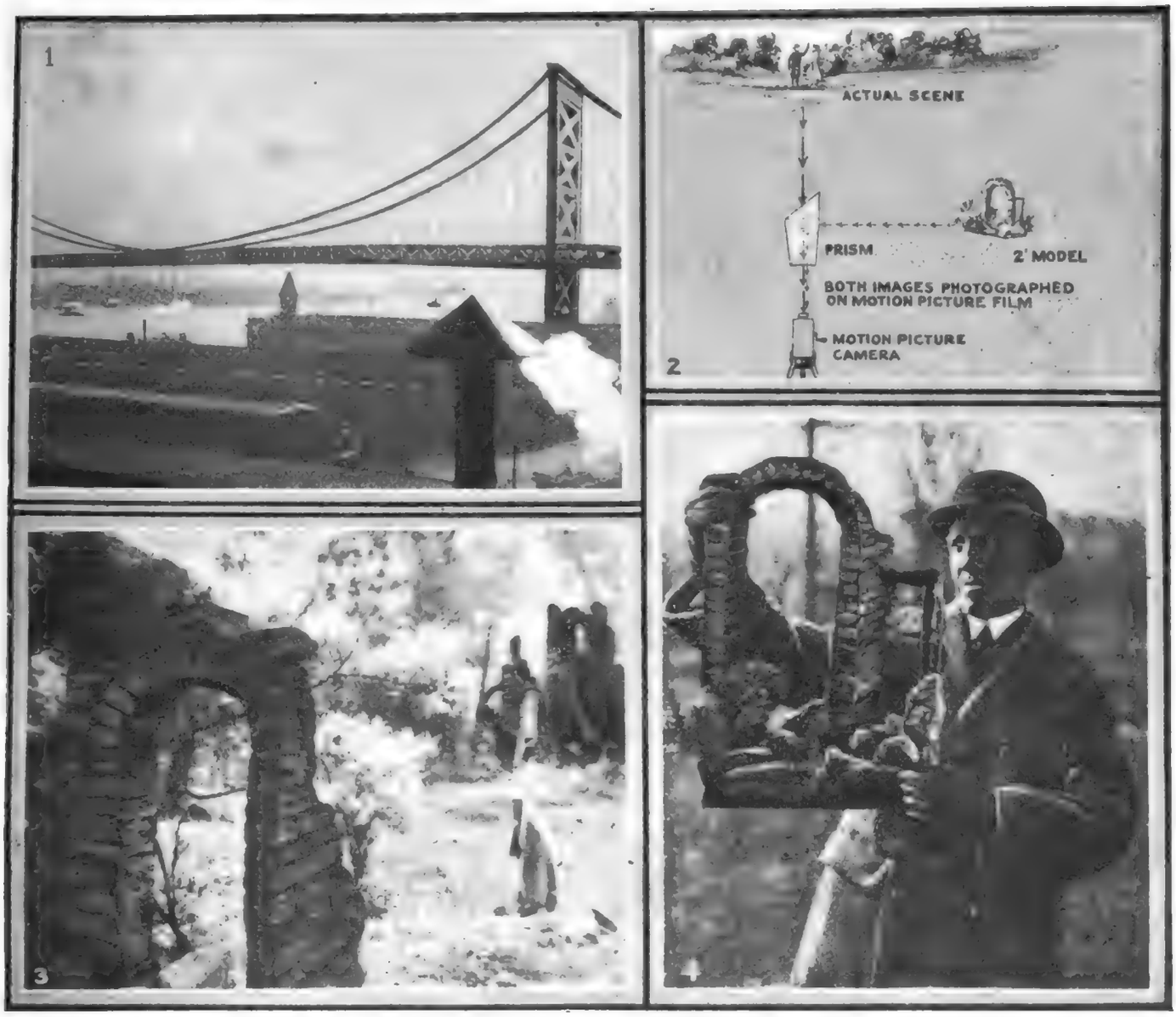
Taking Movie Scenes in Miniature

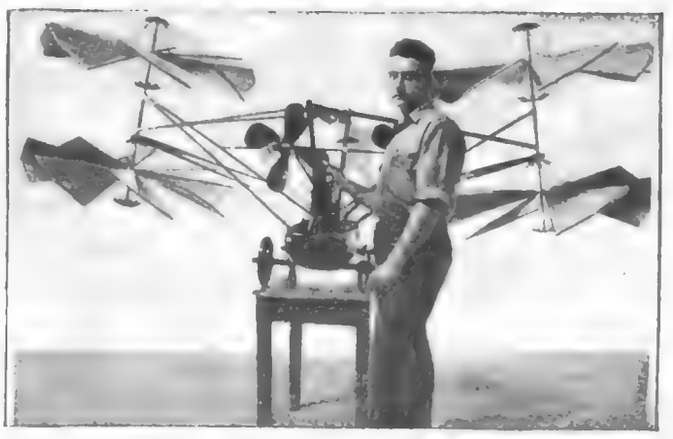


At (1) is shown a photo of the Delaware river bridge at Philadelphia as it will appear in 1926 when it is completed. The photo was taken with a new device invented by Rex Stovel to enable movies to be made with miniature "sets." Although the actual process is still a secret, pending patenting, the sketch at (2) shows how it may be accomplished by using a prism. The two lower pictures show an actual movie scene made with the device. The one to the right shows the inventor holding the "set" which appears larger than the actors in the scene actually made. The inventor claims that with this scheme practically all "sets" for movies use may be made of papier mache at a small cost instead of the costly life-size products used today. It will be possible to run an automobile into a doll's house or to march an army across a six-inch bridge with the aid of the device.

Windshield Wiper

A Cleveland firm has just brought out a wind-shield wiper for use on trolley cars. It is made on the same principle to a similar device used on automobiles. The long arm with the rubber wiper attached is operated by a small piston and compressed air.

Helicopter Model



The general idea that the helicopter is a new development in aircraft is false as will be seen by the picture above which shows a model of one designed by Sir George Cayley in 1843. Photo shov ber of the U. S. National Museum, Washington, D. C.]cl.

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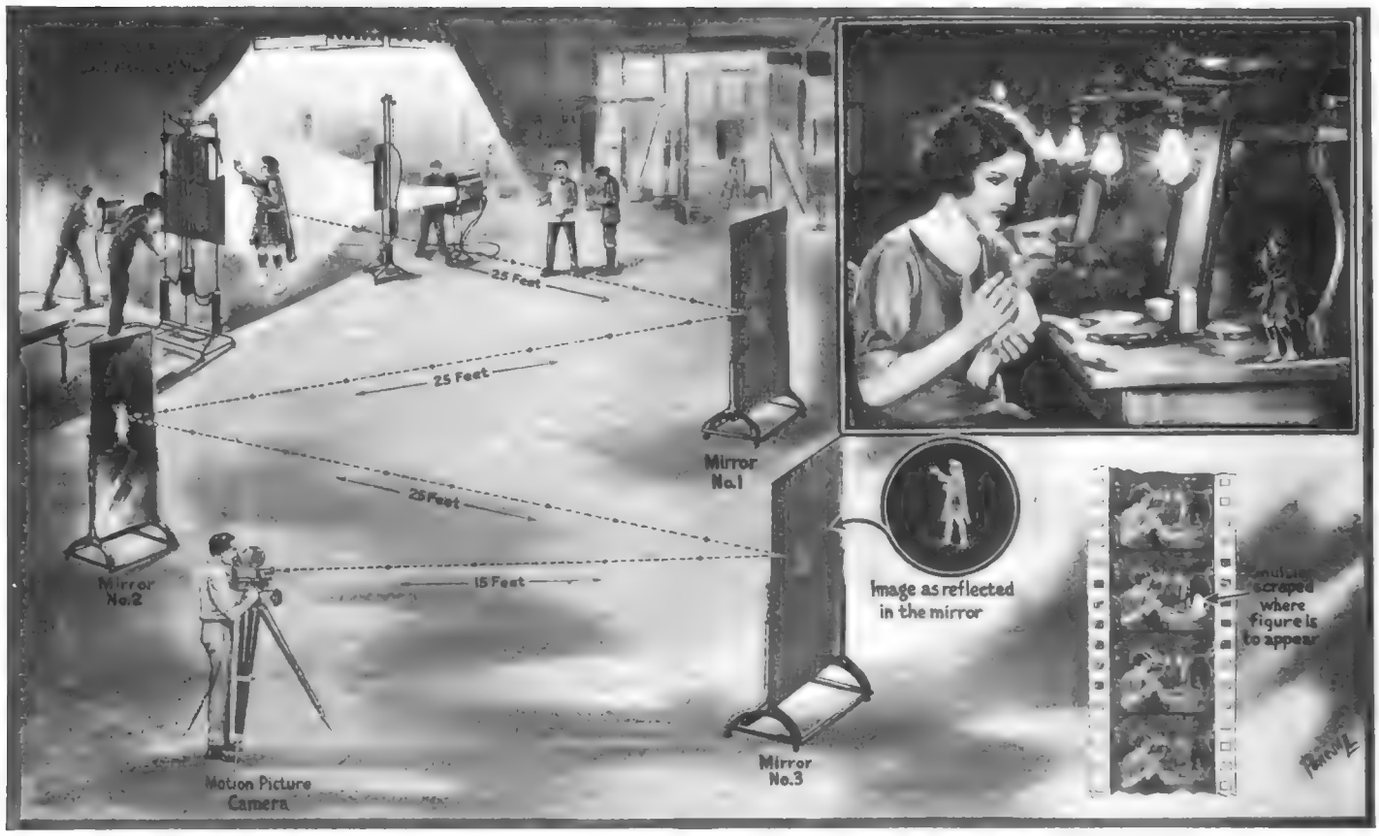
Movie Double Exposure Trick



In Metro's "Rouged Lips," Viola Dana's Scotch inheritance of thrift rises and stands on her dressing table in the form of a small figure to chide her while she contemplates some extravagance. The small figure is obtained by reducing the size of a regular figure with the assistance of mirrors as shown. Then the film is re-exposed to the small figure. Note that it appears against an almost black background, where the emulsion is hardly affected. A part of the film is developed and the position of the small figure scraped clean so the photographer may accurately focus his camera. —Phil. Gersdorf.

TABLE TOP LANDSCAPE PHOTOGRAPHY

salt and paper with some cotton clouds stuck on a dark background, le supported by books ink-bottles or whatnot—erected on the top of the library table and photographed gives very realistic landscape photographs. Other ideas will suggest themselves. —S. Leonard Bastin.

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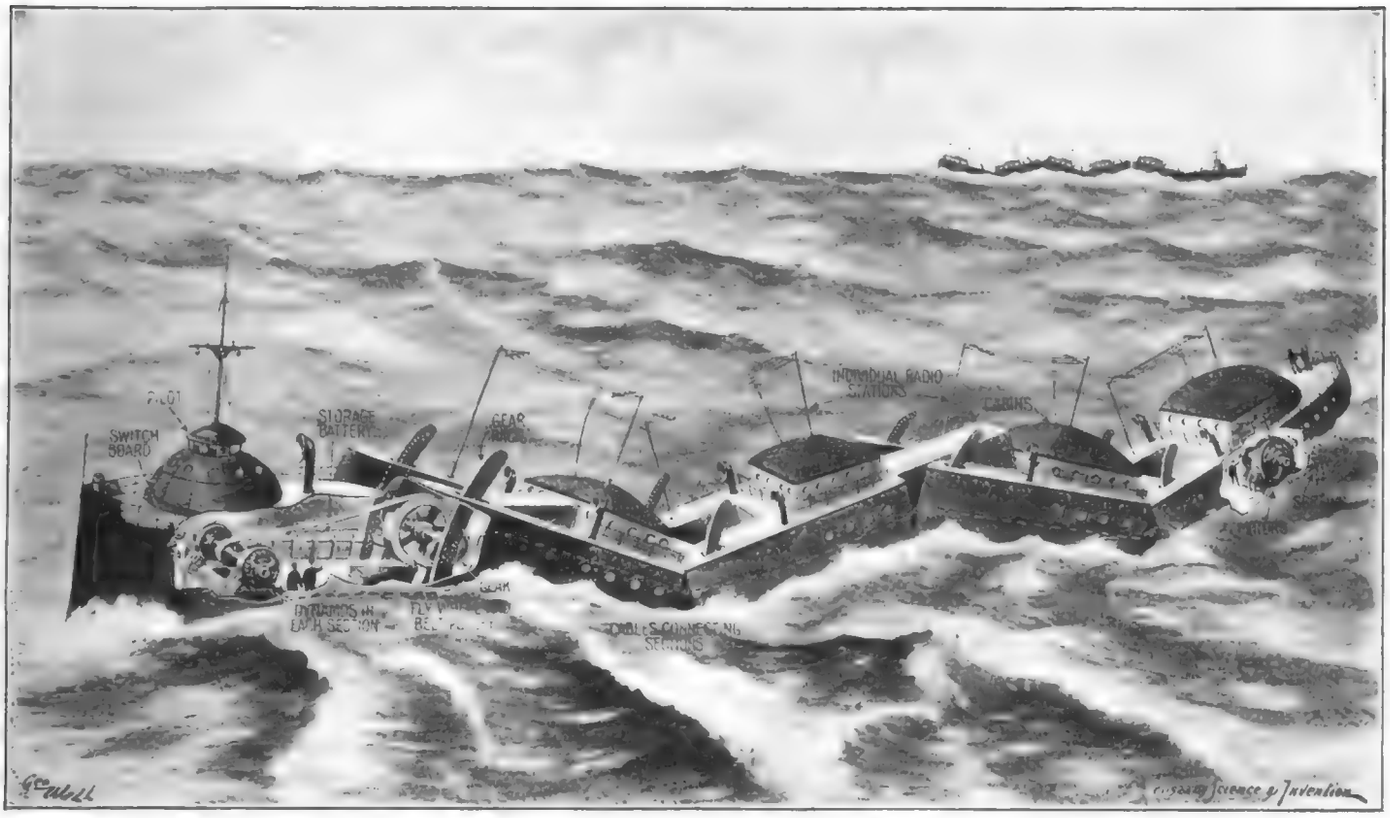
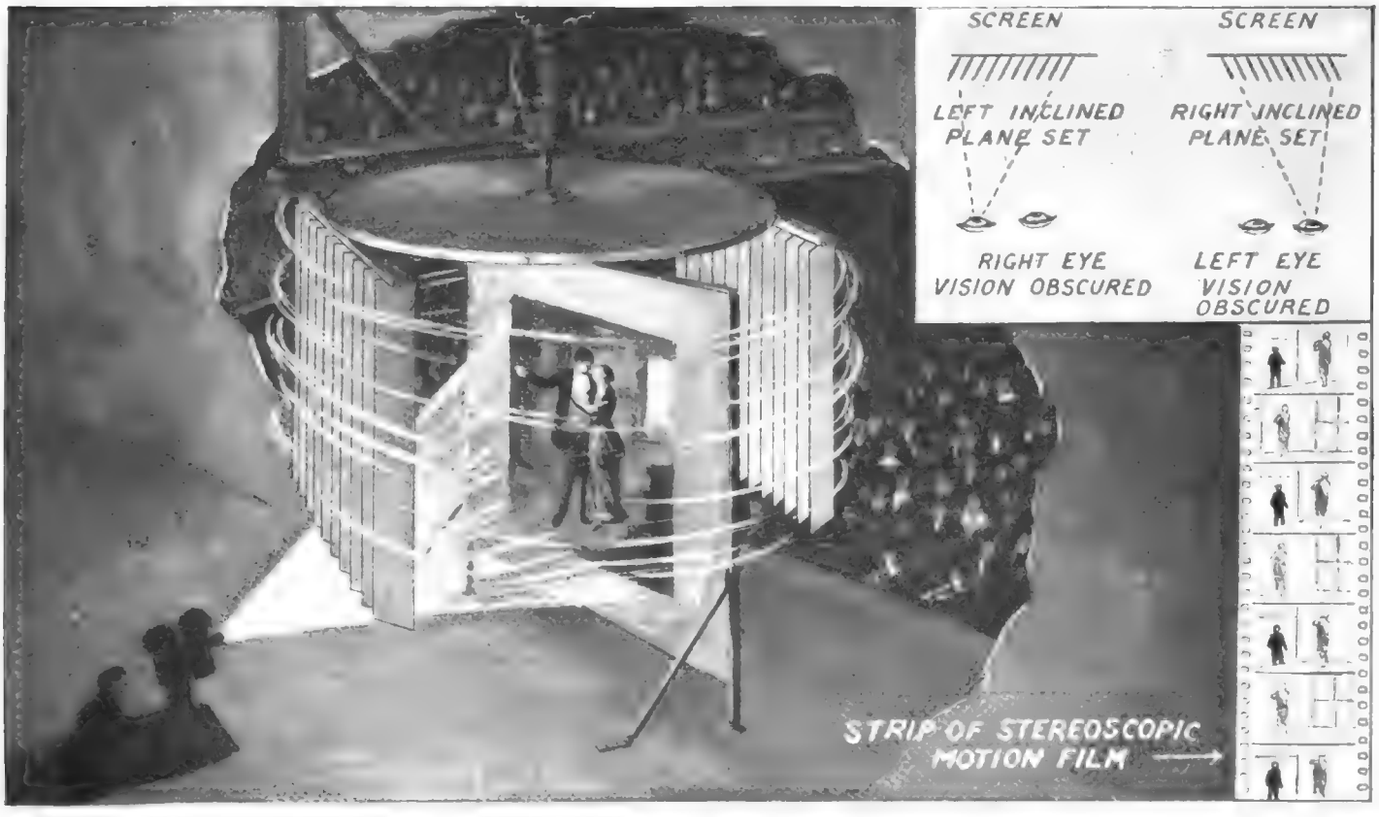
Self-Propelling Wave Ship



The ship shown in the illustration above is built in sections so that they rock up and down with the motion of the waves. This motion runs electric generators in each section. The current generated in this way is carried to the rear of the ship where it runs motors connected with the propellers thereby propelling the ship. There are storage batteries also that collect the surplus current so it may be used when the sea is quiet. The gears are made so that both the up and down motion of the waves are used.

Stereoscopic Motion Pictures



By means of revolving shutters that pass before the screen an English inventor has found a means of producing stereoscopic movies—movies in which the figures stand out in bold relief as they do naturally. The special film used with this method is taken with a stereoscopic movie camera that exposes one side for one frame and the other for the next. The revolving shutters that allow the scenes to be viewed first with the right eye and then the left works in synchronism with the camera. The projector is behind the transparent screen.

—Cedric Marshall.

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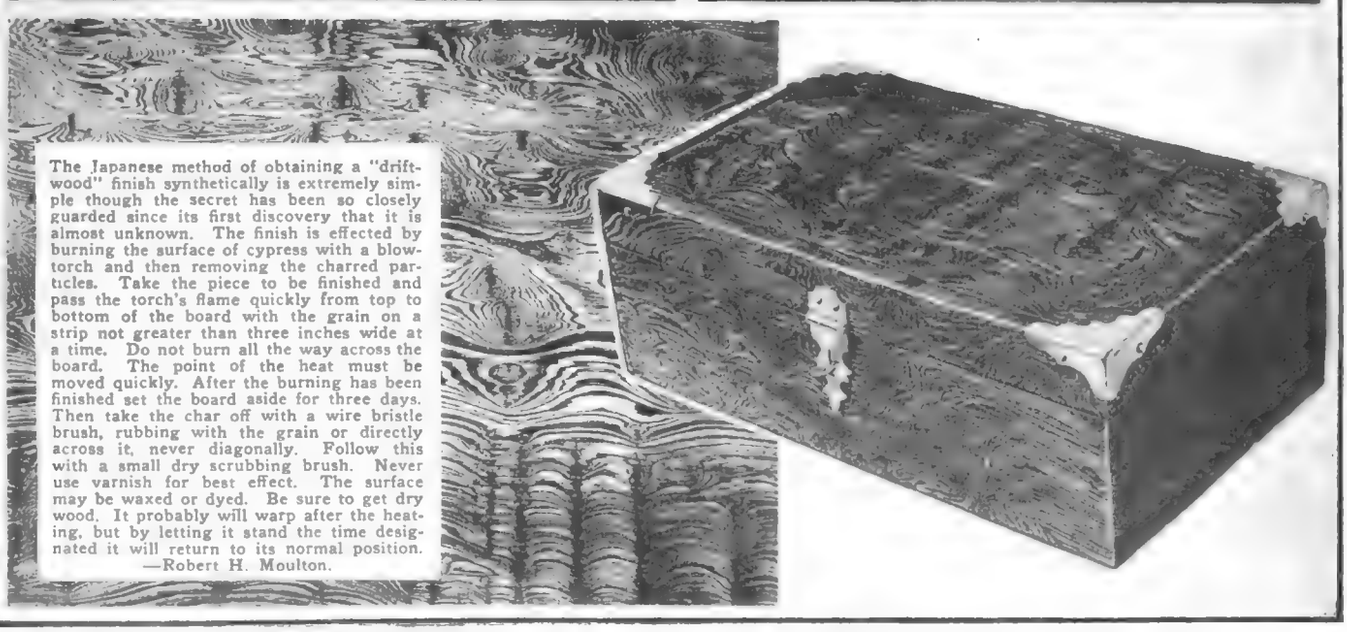
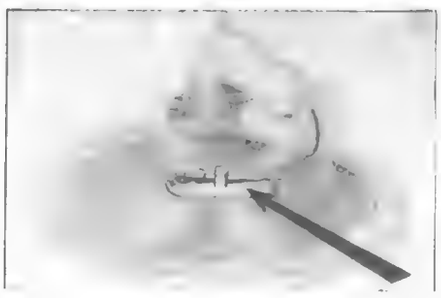
Driftwood Finish for Cypress



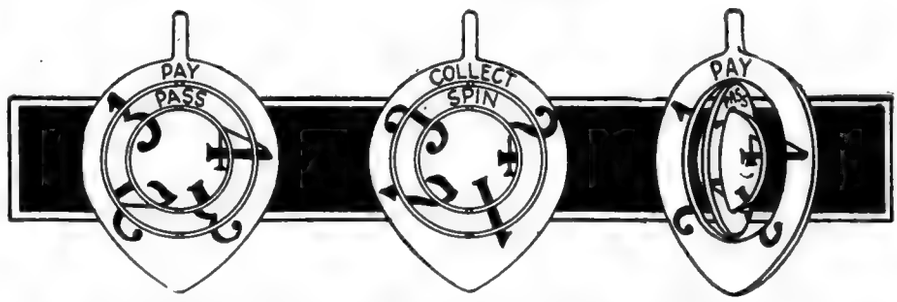
The Japanese method of obtaining a "driftwood" finish synthetically is extremely simple though the secret has been so closely guarded since its first discovery that it is almost unknown. The finish is effected by burning the surface of cypress with a blowtorch and then removing the charred particles. Take the piece to be finished and pass the torch's flame quickly from top to bottom of the board with the grain on a strip not greater than three inches wide at a time. Do not burn all the way across the board. The point of the heat must be moved quickly. After the burning has been finished set the board aside for three days. Then take the char off with a wire bristle brush, rubbing with the grain or directly across it, never diagonally. Follow this with a small dry scrubbing brush. Never use varnish for best effect. The surface may be waxed or dyed. Be sure to get dry wood. It probably will warp after the heating, but by letting it stand the time designated it will return to its normal position.

—Robert H. Moulton.

An Improved Toddle-Top



" repeater consists of an arm to lift the repro- " er and a spring to throw it back.



The three concentric disks fastened to a common shaft and arranged with numbers is the latest in gambling devices. The illustration above shows how it designates the "put and take."

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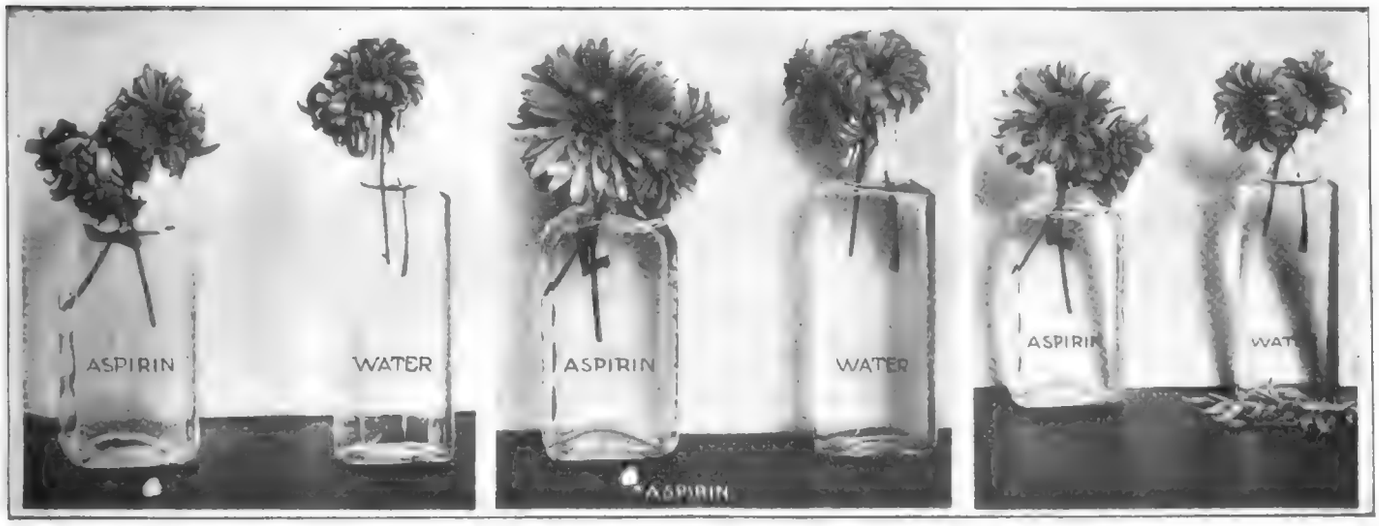
Methods Of Preserving Flowers

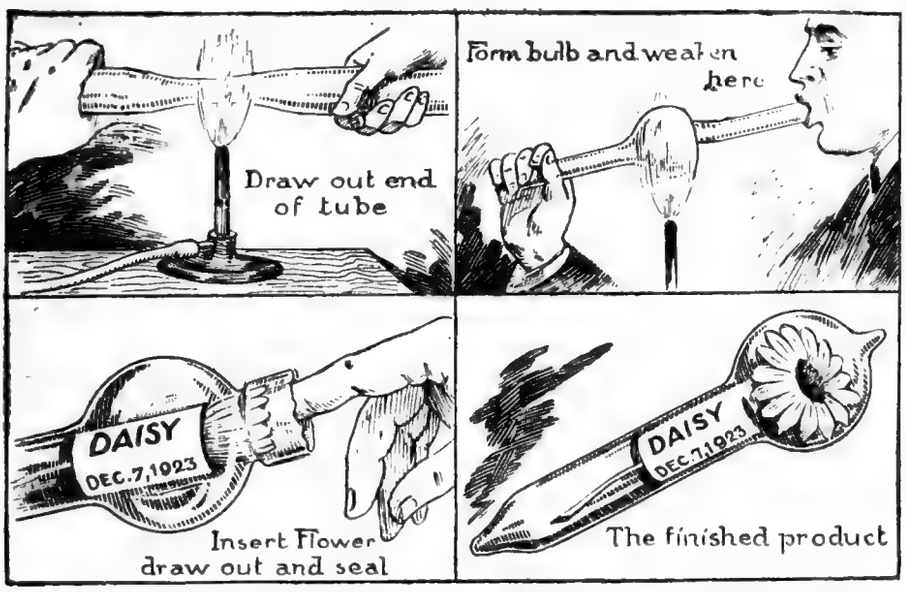
Simple methods of preserving the freshness of flowers after picking—

Rhododendron as a thermometer.



Wilted flowers can be revived and their former bloom brought back by simply placing in water in which a quarter tablet of aspirin is dissolved, as shown by the pictures above. Note that the aspirinated flowers revived while those in water remain wilted. Last photo 48 hours after first.

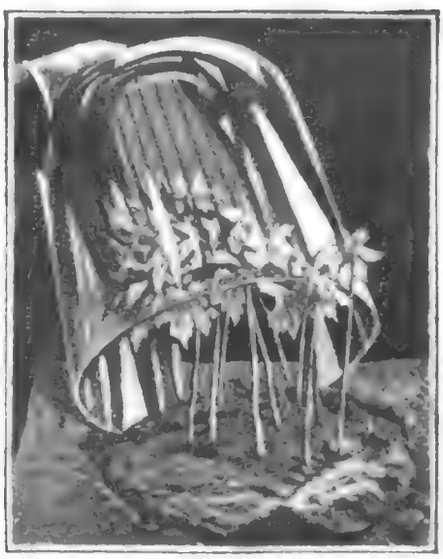
Insertion of blooms in glass tubes keeps them fresh for two years.



By placing a bloom in a sealed glass tube blown as shown above they may be preserved in their original state for two years. The paper with the name and date helps support the stem of the plant. If the tube is filled with an inert gas like nitrogen the flower will remain fresh much longer. After sealing the tube it should not be allowed to remain in the sun light on account of the deteriorating effects of the ultra-violet light.

—H. O. Bernstrom.

Sand and Shade Method



By placing the stems of fresh blossoms in a few inches of moistened sand and covering the whole with a glass shade, if kept in a cool, shady place, the flowers will remain fresh for weeks. At the first sign of mold place a piece of cotton-wool soaked in formalin beneath the shade.

—S. Leonard Bastin.

RHODODENDRON MAKES A GOOD THERMOMETER

The Rhododendron gives clear indications of temperature. Its leaves form a natural thermometer. When the temperature is at about 50 deg. F. the leaves are held up. If the cold increases to freezing point the foliage becomes horizontal while at zero the leaves droop and roll inward.—S. Leonard Bastin.

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New York's Photo by Searchlight

By P. R. BASSETT

The above photo of the New York skyline was made from the top of a Brooklyn skyscraper with the aid of a Sperry searchlight of one billion candle-power. It was located on the roof of a building about one and one-half miles from the sky-line. The camera was set up on an adjacent roof. The beam was played up and down the surface of each building. Twenty minutes was required to "wash" the whole sky-line in light. The light recorded on the plate from which this picture was developed equaled 55 billion candle-power. The method of playing the searchlight is evident by the contrast.

A French Work-Bench

The combined work-bench and vise shown above is the French idea of the acme in home shop equipment. The whole thing is made of light sheet steel with the legs bored so that the whole may be secured to the floor. There are two principal designs manufactured. One is equipped with drawers and the other with a large metal box for holding the tools. A stool is supplied also.

Extinguisher

The little extinguisher shown above is the regular chemical type put up in a glass bulb. It breaks when thrown into the base of the flames.

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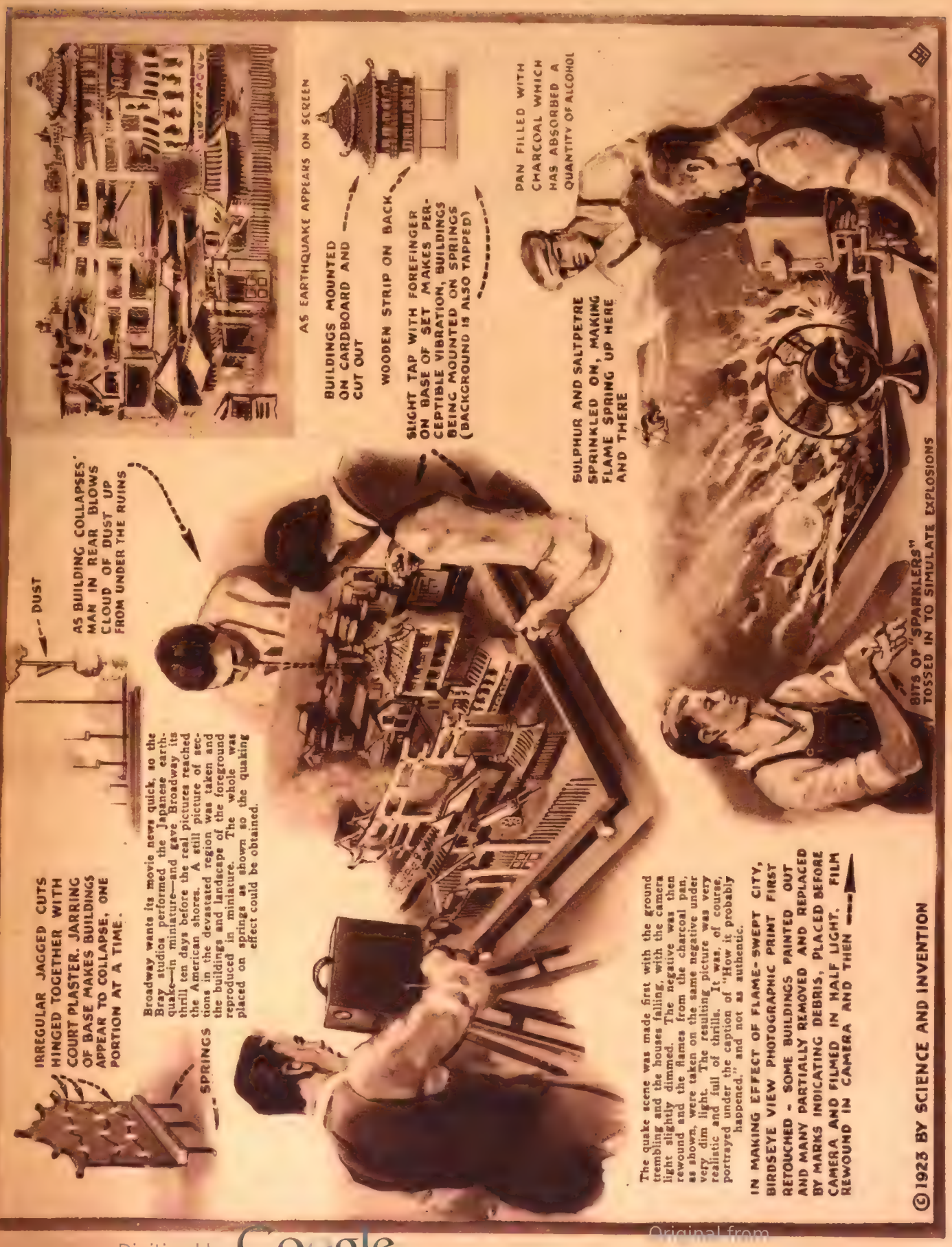
Fake Earthquake Movies

How Jaded Broadway Got a View of the Earthquake Three Days After It Occurred.

BY W. B. ARVIN


AS EARTHQUAKE APPEARS ON SCREEN
BUILDINGS MOUNTED ON CARDBOARD AND CUT OUT
WOODEN STRIP ON BACK
SLIGHT TAP WITH FOREFINGER ON BASE OF SET MAKES PERCEPTIBLE VIBRATION, BUILDINGS BEING MOUNTED ON SPRINGS (BACKGROUND IS ALSO TAPPED)
PAN FILLED WITH CHARCOAL WHICH HAS ABSORBED A QUANTITY OF ALCOHOL
SULPHUR AND SALTPETRE SPRINKLED ON, MAKING FLAME SPRING UP HERE AND THERE
BITS OF "SPARKLERS" TOSSED IN TO SIMULATE EXPLOSIONS
DUST
AS BUILDING COLLAPSES MAN IN REAR BLOWS CLOUD OF DUST UP FROM UNDER THE RUINS
IRREGULAR JAGGED CUTS HINGED TOGETHER WITH COURT PLASTER. JARRING OF BASE MAKES BUILDINGS APPEAR TO COLLAPSE, ONE PORTION AT A TIME.
SPRINGS
Broadway wants its movie news quick, so the Bray studios performed the Japanese earthquake—in miniature—and gave Broadway its thrill ten days before the real pictures reached the American shores. A still picture of sections in the devastated region was taken and the buildings and landscape of the foreground reproduced in miniature. The whole was placed on springs as shown so the quaking effect could be obtained.
The quake scene was made first with the ground trembling and the houses falling, with the camera light slightly dimmed. The negative was then rewound and the flames from the charcoal pan, as shown, were taken on the same negative under very dim light. The resulting picture was very realistic and full of thrills. It was, of course, portrayed under the caption of "How it probably happened," and not as authentic.
IN MAKING EFFECT OF FLAME-SWEPT CITY, BIRDSEYE VIEW PHOTOGRAPHIC PRINT FIRST RETOUCHED - SOME BUILDINGS PAINTED OUT AND MANY PARTIALLY REMOVED AND REPLACED BY MARKS INDICATING DEBRIS, PLACED BEFORE CAMERA AND FILMED IN HALF LIGHT. FILM REWOUND IN CAMERA AND THEN
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"Not exactly—Magnifying the features helps a little, but not much. I get my best results by distorting the features, that is to say by magnifying the one trait I am examining, whether anger, jealousy or some other passion. In a word these mirrors produce caricatures—One is designed to intensify a man's looks of envy, another his sensuality, etc.—I sit a man in the middle of this room and look into each of these analyzing mirrors in turn.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

[Author's Note. The fabled "Waters of Lethe" possessed a curious power. Anyone who drank of the water at once lost all memory of his former life. Nature, too, has her Waters of Lethe. As we grow old, the memories of recent events fade from our mind, only those of our earlier years remaining with any degree of clearness. Diseases of the brain, too, can blot out the memories of past years. Some day, when our scientists understand better what memory is we may hope to find the means of thus blotting out certain of our recollections artificially. In this story I have endeavored to show how this power of obliterating memories might be made use of in the reformation of criminals.]

"DOCTOR HACKENSAW," cried Pepita Perkins, gaily, "Why don't you invent some means of preventing people from spitting in the street cars? Couldn't you make some contrivance that would rap the spitter on the head, or blow a strong puff of wind in his face when he tries to spit?"

Doctor Hackensaw laughed. "I have already invented such a device, Miss Pep," said he. "Moreover, my invention is simple, inexpensive and I will guarantee it. It is nothing more than to hang up the following sign in the street cars:

"ONLY HOGS SPIT ON THE FLOOR!"

"When a man disregards the sign and expectorates, his neighbor will naturally look at the sign and laugh. The most hardened spitter could not stand such ridicule. He will leave the car at the first opportunity, and, it is safe to say, the lesson will never have to be repeated.

No. 24
The Secret of the Memory Obliterator

"Understand me, Miss Pep, I am not, as a rule, in favor of ridicule as a means of education—in fact, I believe ridicule is used far too much already by both parents and teachers—especially in Europe, but it is a powerful weapon, and there are times when its use in justified."

"Is it to make people look ridiculous that you use those horrid mirrors on the wall? They make me look like a fright! They're worse than any of those at Coney Island!"

DISTORTION MIRRORS IN READING CHARACTER

"Those," said Doctor Hackensaw, smiling, "are my distorting mirrors, and I am very proud of them. You must know, Miss Pep, that at present I am engaged on the problem of reforming criminals, and before reforming a man I must know something about him. These mirrors tell me what I want to know, they enable me to read a man's soul!"

"What!" cried Pep, thinking the doctor must be jesting.

"Sit down, please, and I will explain myself. Of course you will understand that the words 'crime' and 'criminal' are very elastic, and often apply to things that in reality have nothing criminal about them. However, you will understand me when I say that my efforts are directed toward nullifying the vicious tendencies in men, and strengthening the good ones. But, in order to accomplish anything, I must be able to read a man's character accurately. And a man's face is an index to his character."

"Not always," interrupted Pep. "I've known some scoundrels that looked like honest men, and some honest men that looked like villains."

"True, but that is because you did not use scientific methods. Science demands instruments of precision, not mere guess-work. I don't suppose you know, Miss Pep, that Darwin made a careful study of the expression of the emotions in man and in animals, and showed that the same emotion is expressed in the same way by animals of the same species. Any man familiar with dogs knows that a dog's tail can express a variety of different emotions. Watch the meeting of two strange dogs. At sight of each other there tail's remain stationary—mute. They are on the alert. Then one dog wags his tail tentatively, and the other answers. Friendship is declared. Then along comes the master of one of the animals and the dog slinks away with his tail between his legs. Could any language be plainer?"

"No, but they're only dogs."

"Man too," continued the doctor didactically, "expresses his emotions by means of gestures, but principally by the expression of his features. I am safe in saying that every emotion a man experiences, whether fear, anger, hate, jealousy, sensuality, or joy, is expressed to a certain degree in his face. Of course, he has learned to school himself and keep his features more or less under control, but the expression is in his face, however imperceptible it may be to a casual observer."

"Well?"

MAN'S FACE REVEALS HIS EMOTIONS

"Well, the wrinkles that appear in our faces with age, are the result of such expressions of emotion, often repeated. A man who

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continually frowns, or who is stern and cold will have wrinkles that betray him. An experienced observer can often tell at a glance a man who is cruel, vindictive, envious, lascivious or dangerous, merely by the expression of his face. We all of us express these passions by much the same play of features. And every such emotion leaves its trace . . . barely perceptible, but each repetition strengthens it. A man's character is thus indelibly stamped upon his face. The difficulty consists in reading it correctly. It is for the purpose of reading this facial expression that I use these distorting mirrors that you see here. By means of these I can read any man's character without a mistake. Of course, in a boy or girl, the character is not so deeply impressed on the face as in an adult, but it is there all the same, and I can read a person as if he were a book."

"I see—you magnify the features."

HOW EACH TRAIT IS MAGNIFIED FOR STUDY

"Not exactly—Magnifying the features helps a little, but not much. I get my best results by distorting the features, that is to say by magnifying the one trait I am examining, whether anger, jealousy or some other passion. In a word these mirrors produce caricatures—One is designed to intensify a man's looks of envy, another his sensuality, etc.—I sit a man in the middle of this room and look into each of these mirrors in turn, and after these observations I know the man better than he knows himself."

"Gee!" cried Pep. "You ought to turn phrenologist, doctor, give a man a chart of his character, and tell him what vocation he is best fitted for. Or you could examine candidates for office and accept or reject them at a glance, without need of a written examination."

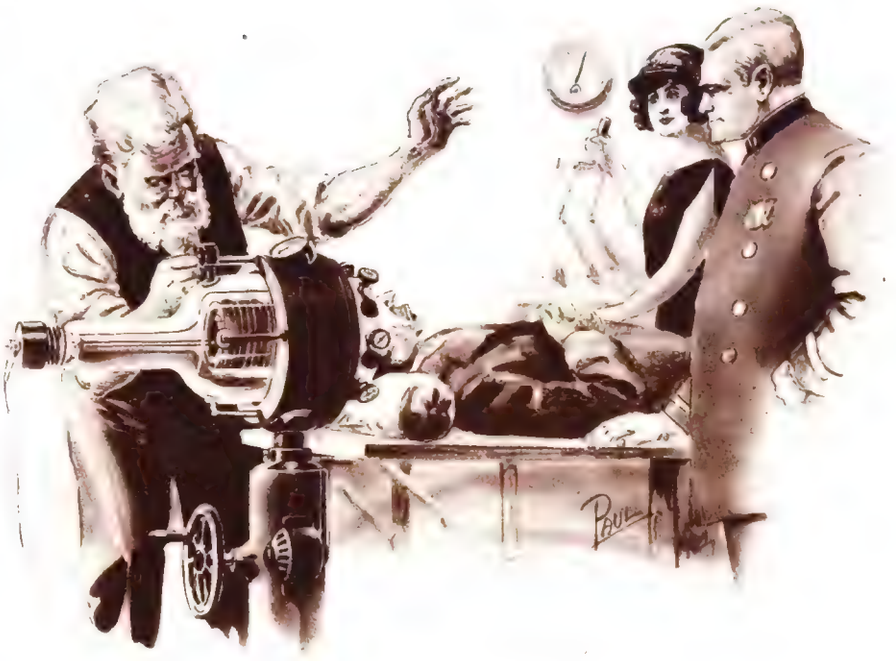
"Yes," replied the doctor, gravely—"there are many uses to which these distorting mirrors may be put, but the greatest one is undoubtedly that of reforming criminals."

At this moment the pair were interrupted by the entrance of the office boy.

"Inspector Fox is below, Doctor Hackensaw, and wishes to see you."

SIX-FINGERED PETE

"Come along with me, Miss Pep," said the doctor. "I am going with Inspector Fox to visit Six-Fingered Pete, one of my subjects. Come along and you will see some of the practical results I have obtained."



Pep and the doctor entered the operating room, where the patient was stretched motionless under the powerful electrical machine that was to destroy his memories of a life of crime and make a new man of him. An anaesthetic had been administered and all was in readiness. Doctor Hackensaw rapidly divested himself of his coat and carefully adjusted the micrometer screws that regulated his "Memory Obliterator."

Six-Fingered Pete, so-called because he was born with six fingers on one hand, was, at the time, under sentence of death for murder. He was a criminal of the worst type, having been, so to speak, born to crime. His father had been a burglar and his mother a thief and drunkard of the lowest class. Pete himself had been reared in the slums amid all that was vilest and foulest of New York, in what was at the time known as Mulberry Bend. This plague-spot has fortunately been abolished, a park now occupying its place. It was the haunt of the thief and the prostitute, and stories were current that, for the modest sum of thirty dollars, you could hire any one of a dozen men to rid you of a troublesome rival or for a few more dollars have a policeman killed.

Naturally enough, in this foul place, Pete soon grew to be a rogue. In fact, he rapidly outstripped his fellows. At ten he was a clever pick-pocket, and even assisted the local gangs of crooks in their burglaries, his small size rendering him valuable for entering houses through transoms, and unlocking the door for the older members of the gang. As he grew older and bolder, he became himself a leader, starting a gang of his own, which was a terror to the neighborhood. He was suspected of several murders, but nothing could be proved against him. Finally, however, he was caught red-handed after murdering a member of his own gang. The fellow had turned traitor and his testimony had sent Pete to prison for a term of years. Pete had sworn vengeance and had obtained it immediately upon his release.

This was the man whom Doctor Hackensaw was about to visit.

"You see, Miss Pep," explained the doctor, "It's no sinecure I've undertaken. If I can succeed in reforming Pete, it's a proof that my method is a good one. Eugene Sue in one of his books, recommended blinding criminals to reform them. The loss of their eyesight would render them powerless to commit new crimes. My method is more humane, however, and more efficient."

Six-Fingered Pete was not a pleasant personage to look at. A coarse, brutal, sensual face told its story without need of the doctor's distorting mirrors. A dangerous man, evidently, with a large muscular body that made him look strangely menacing.

"There, Miss Pep," said the doctor, "that is the man whom I have undertaken to reform. He is condemned to death, but I have succeeded in obtaining a promise of his pardon if I can really succeed in reforming him. The fellow has consented to let me try my hand. It is his last hope, and be-

(*Continued on page 792*)

Pete had awakened none the worse physically, but his mind had become a complete blank. It was curious to watch him as he tried to rise from his bed. He was more helpless than a babe, for his muscles had lost all power of co-ordination.

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Around the Universe

By RAY CUMMINGS

6TH AND FINAL INSTALLMENT

The new asteroid—five hundred miles in diameter, a white-hot core with flames hundreds of miles in height leaping from it, plunged for the Sun. But Mars also lay beneath it though slightly off to one side—Mars, now a huge reddish, smug-looking crescent across the lower firmament.

SYNOPSIS OF THE FIVE PRECEDING INSTALLMENTS

WATCHING a game of cards, "Tubby" suddenly finds himself out in the open under the stars, endowed with a power of wishing. He wishes for a knowledge of astronomy and is confronted by a Professor Isaac Swift DeFoe Wells-Verne. They start for Venus in the Professor's space flyer.

Arriving, they meet Ameena, an inhabitant of Venus and she tells them that the earth is going to be attacked by Martians and the Twilight People of Mercury. The three decide to set out to the various planets to solicit aid, in behalf of the earth. They land on Jupiter and are interviewed by the Great Mogul who laughs at them and refuses help.

Leaving Jupiter they head out into space, passing near the rings of Saturn. Arriving at Uranus, they find that it is not inhabited. The same condition is found on Neptune. Therefore, in hopes that some of the stars are inhabited, they head toward Alpha Centauri.

In passing Alpha Centauri they find no possibility of habitation. Sir Isaac then informs his companions that he has very nearly completed calculations which will save the earth from destruction and, he continues, he is going to visit the "Edge of Space." He believes that by the time they conclude the trip his problem will be solved and he can save the earth. For nearly a week they travel, attaining a velocity of 5,593,056,000 miles per second. Sir Isaac then goes on with his calculation and finally announces that he is successful.

"Tubby" and Ameena become engaged to be married, having fallen in love with each other.

Soon they sight beneath them what seems to be a cliff and proceed toward it. As they descend along the side of it a huge ball of fire flashes past. In size it was ten times larger than the space traveler itself. A shock is felt and the travelers are hurled to the floor. Sir Isaac announces that they have reached the inner surface of the atom containing our universe and solar system, and that the ball they saw was a street light in one of the cities on the inner surface and that the vehicle collided with the coat sleeve of a pedestrian, causing the shock.

CHAPTER XI.

IN WHICH THE MATHEMATICAL GENIUS OF SIR ISAAC PLAYS HAVOC WITH THE MINOR PLANETS, BUT SAVES THE EARTH FROM DISASTER.

THE vehicle had passed within the orbit of Jupiter on its return voyage before Sir Isaac deemed it expedient to explain to his fellow voyagers his mathematical plan for the salvation of the Earth. It was the morning of the day before Mars was to be in opposition with the Earth. To be exact, just thirty-four hours remained at the moment the orbit of Jupiter was crossed.

The return trip—of a little less duration than the voyage out—had been devoid of any exciting events chiefly owing to the unflagging vigilance of Sir Isaac. His genius for astronomy—by some method which he did not see fit to explain to his friends—enabled him unerringly to find his way back to the proper Universe, and thence to the Solar System.

During these days and weeks, sleeping little, Sir Isaac had remained almost constantly at his post at the instrument room floor window, or at the table beside the keyboard, verifying over and over again, his gigantic calculations; or writing on his now very bulky manuscript. Tubby and Ameena, left thus to their own devices, passed the time pleasantly enough, singing their duets whenever Sir Isaac would let them, and always cooking the meals and washing the dishes together. The wedding had now been set to take place on the Earth, immediately upon their arrival, with a honeymoon trip to Venus.

At meal time which the three friends occupied principally with argument and with scientific dissertations from Sir Isaac, Tubby had once remarked:

"Say, fellers, them inhabitants of the Edge of Space we been talkin' about, they must've been awful big, perfessor. Big as anybody could get. Ain't I right?"

Sir Isaac, in a manner that now was becoming quite habitual, smiled condescendingly.

"My dear fellow, those inhabitants of the Inner Surface of our Atom may be, possibly, several hundred times larger than ourselves. But, like us, they are merely denizens of an infinitesimal Atom. The inhabitants of that outer world are so much larger that their most powerful microscopes—assuming they have microscopes—would be necessary even to see our Atom itself much less see us or the planets in it!"

Within the orbit of Jupiter—they were heading for Mars and had passed a very considerable distance from Jupiter itself—Sir Isaac materially checked their velocity. The region of the Minor Planets lay ahead.

Past the side window, very close outside, a gleaming white object flashed! Sir Isaac, Tubby and the girl leaped to their feet in fright. A glance upward out of the side window was enough. It was that same Mercurian vehicle, hovering here between Mars and Jupiter, awaiting their return! The glistening white cube was receding rapidly above them. Suddenly it turned, and as they hurried into the store room to observe it from there, it came rushing toward them again. "It's runnin' into us!" Tubby cried in terror.

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It was among them that he planned to operate.

SIR ISAAC EXPLAINS HIS PLAN TO SAVE THE EARTH

After breakfast that morning he called Tubby and the girl into the instrument room and very quietly but solemnly announced that he was ready to explain his plan. Tubby and Ameena sat together in the huge easy chair, she perched on his lap, and hand in hand they prepared to give Sir Isaac their closest attention.

"My dear friends and fellow voyagers," Sir Isaac began, with something of the tone of a public lecturer, "we come now to the most important, most remarkable, and I may say the most awe-inspiring event of our scientific adventure around the Celestial Universe."

"I *wish* he did not have such long prefaces," Ameena whispered to Tubby.

"Sh! you'll make him mad," Tubby whispered back. "He don't mean nothin'. He gets that way from writin' so much."

"As you both know," Sir Isaac went on, ignoring these whispered asides, "at 6:15 P. M. tomorrow evening the Planet Mars will be at its closest point to the Earth. We anticipate then that the combined Martian and Mercurian armies will voyage to our Moon, which already they have conquered, there to prepare to attack the Earth. It is necessary, therefore, for us to prevent this migration. If we can keep the armies on Mars their small force now occupying our Moon will be powerless for offensive movement. We could even send armies from Earth to destroy them; or, at the next opposition doubtless they would return to Mars of their own volition."

"Right," Tubby agreed impatiently. "But *please* tell us how we're goin' to stop the Mars armies from movin' over to our Moon."

"I will," stated Sir Isaac. "But first you must understand the scientific laws governing what we are about to do. A poet once said, 'Thou canst not touch a flower without troubling of a star.' He did not mean it scientifically perhaps, but its scientific application is very pertinent. It means that if you so much as pick a flower anywhere in the Universe, you alter, by some minute fraction, the course of every star—every celestial body, no matter how distant, or how gigantic.

"I wish the Earth was revolvin' ten times as fast! I wish—" Sir Isaac's body left the ground, hurtling into the air like a bullet. Tubby grasped one arm around Ameena, and one about the tree-trunk. He felt like a balloon tugging at its leach. The wind was a cyclone. A house went sailing off through the air—Bill Hawkins' house.

THE UNIVERSE DELICATELY BALANCED

"I see you do not quite understand me. The celestial Universe is very delicately balanced. Every force acting upon the celestial bodies has another force to counteract it. Now since every body attracts every other body directly as the mass, you will realize that a daisy growing in a field on Earth attracts Neptune or Mars just as much in proportion to its mass, as they attract the daisy. And since attraction is inversely as the square of the distance, it follows that if you pick the daisy, thus altering its position, you alter its attraction. And therefore—very minutely, of course—you disturb the movements of every body in the Universe."

"I think we understand you," Ameena said. Sir Isaac had paused, and this time Tubby had failed to make any comment. "It is really very interesting. Do go on, Sir Isaac."

Sir Isaac continued:

"Well, I propose to do just that very thing. To——"

"Pick a daisy?" Tubby put in. He glanced at Ameena for approval of this quip, but she frowned.

"To so alter the course of some very small celestial body—by using the attraction of our vehicle upon it—that a series of collisions, progressively greater in the masses of the colliding bodies, will rapidly occur among the Minor Planets."

"Oh," said Tubby, somewhat abashed. "Then what?"

"I have figured it out very carefully," declared Sir Isaac. "You may appreciate possibly the abstruseness and the delicacy of such a calculation. The collisions will climax at 5:34 P. M. tomorrow afternoon, by——"

The sentence was never finished. Past the side window, very close outside, a gleaming white object flashed! Sir Isaac, Tubby and the girl leaped to their feet in fright. A glance upward out of the side window was enough. It was that same Mercurian vehicle, hovering here between Mars and Jupiter, awaiting their return!

"Say—what the—did they try an' run into us?" Tubby gasped.

The glistening white cube was receding rapidly above them. Suddenly it turned, and as they hurried into the store-room to observe it from there, it came rushing toward them again.

ATTACKED BY THE MERCURIANS

"It's runnin' into us!" Tubby cried in terror. "Hey perfessor! Let's do somethin'—let's get a-goin' somewhere!"

Sir Isaac rushed back to the keyboard. The horrible meaning of the situation became clear. The Mercurian vehicle, manned by "suicide volunteers," was endeavoring to destroy them and itself simultaneously by a collision in Space!

(*Continued on page* 794)

It came at 5:51 P. M.—as Sir Isaac had calculated — a soundless flash, and then a new, larger celestial body, the fused mass of the other two bodies, wavering in Space, plunging diagonally toward the Sun, and at last finding its new orbit by that delicate balancing of forces which is the marvel of Celestial Mechanics. Sir Isaac was jubilant. He took several observations of the new asteroid. "Perfect, my dear friends. The new orbit is identical with my calculation. There will be another collision, with a much larger planetoid, at 7:19 P. M. Let us have dinner."

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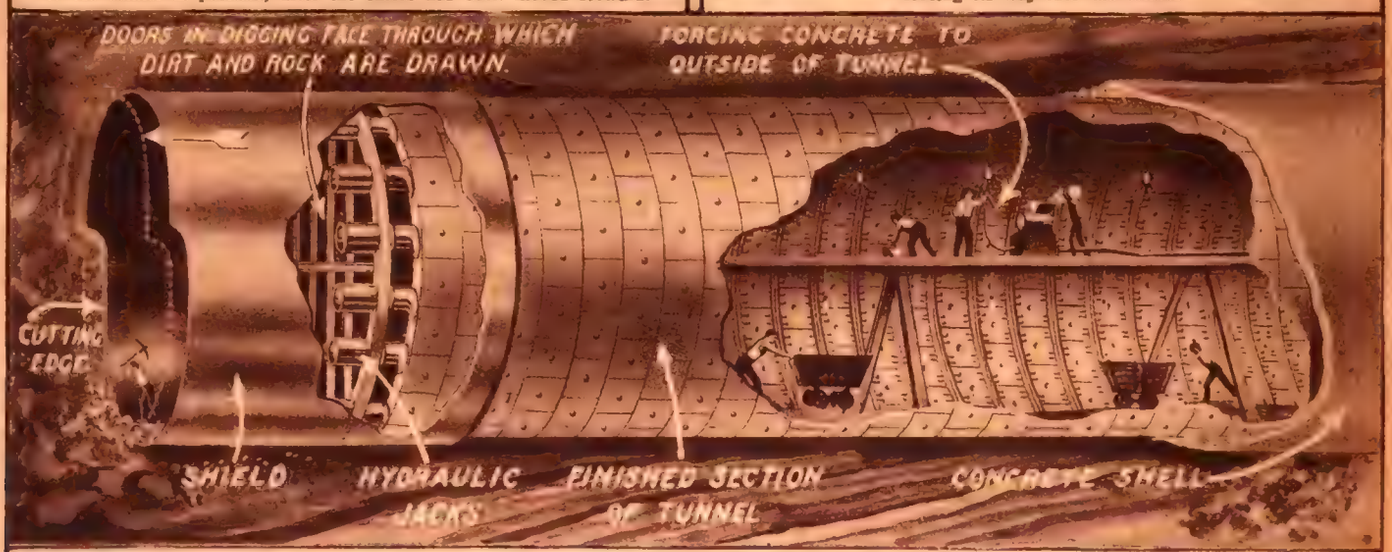
Largest Vehicular Tunnel

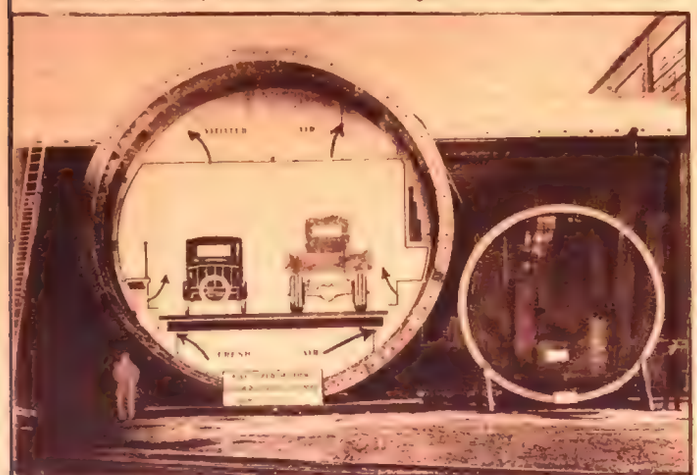
By A. P. PECK

A rear view of the digging face of the shield used in constructing the New York-New Jersey vehicular tunnel under the Hudson River is shown above. The jacks which are used to force the shield ahead may be seen at the side. The large upright arm is used to place the sections of the tunnel in position, after the shield has been moved forward.

Another view of the same portion of the shield showing laborers at work digging through the doors in the face. These men work under an air pressure of twenty-nine pounds per square inch. Occasionally it is necessary to increase this pressure in order to keep the earth from forcing its way into the tunnel.


DOORS IN DIGGING FACE THROUGH WHICH DIRT AND ROCK ARE DRAWN.
FORCING CONCRETE TO OUTSIDE OF TUNNEL
CUTTING EDGE
SHIELD
HYDRAULIC JACKS
FINISHED SECTION OF TUNNEL
CONCRETE SHELL

A diagrammatic view of the shield and a finished section of the tunnel will be seen above. The hydraulic jacks force the shield forward and the dirt and rocks are removed through the finished tunnel after being taken in through the digging face.
When rock is struck, the dirt in the forward part of the shield is removed, and blasts are set to break up the rock. The concrete shell, in semi-liquid form, is forced out under air pressure through holes in each section of the steel wall. When the shield can be forced forward by the jacks this is done until the shield has advanced. Then two or three jacks are removed and a steel section is set in place.



At the left is shown a cross-section of one of the finished segments of the steel tunnel. The system of ventilation can be plainly seen. To the right is shown a section of what was formerly the largest under-river railroad tunnel in the world. The pleasure car and truck indicates how fast and slow moving vehicles will be divided to prevent congestion.

Referring to the above diagram it will be seen how east and west bound traffic will be taken care of by the twin tubes under the river connecting New York and New Jersey. Note the depth of the tubes below the river bed and their distance apart. Pedestrians are taken care of by the walks on the sides. Fresh air will circulate in the tubes.

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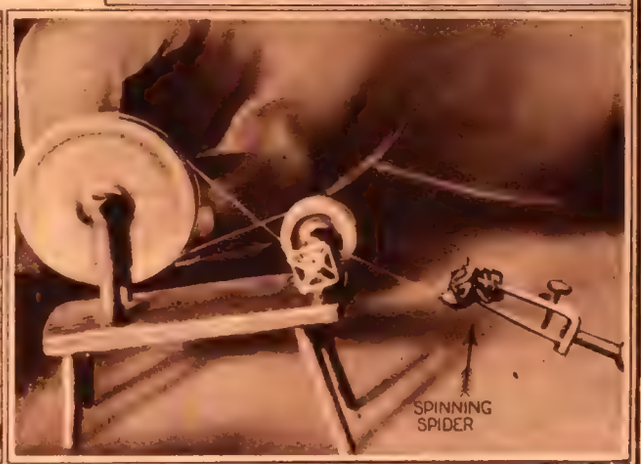
Insects Make Camera Début

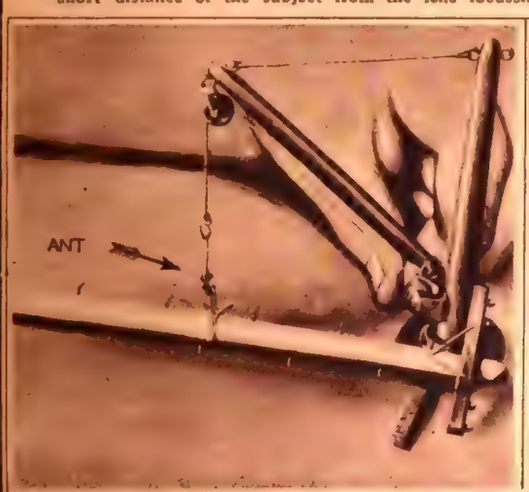
By EDWIN SCHALLERT

SINCE the invention of a new motion picture device, insects as well as microscopic forms of life may be shown on the screen as they appear in their native haunts. The new invention's success depends upon the fact that the strong light which must be played over the subject can be cooled before it strikes them. Formerly it was impossible to make motion pictures of insects because the intense heat of the light killed them almost instantly. A picture of the invention with its inventor, Louis R. Tolhurst is shown at the right. At the left is the profile of a spider, taken with the invention.

ABOVE is shown a close-up of the same spider in a mood of vengeance. In fact, he is just ready to leap at his opponent, whom he ate with hearty gusto a few seconds after this picture. Here he is crouched for the spring. As spiders and insects generally do not heed a director's megaphone to any great extent, the job of the camera man is a hard one, since he has to be ready at all times and then await the pleasure of Mr. Spider or Beetle before he begins "shooting." On account of the short distance of the subject from the lens focussing is hard.



AFTER a number of days of careful waiting and just as careful handling, spider in the above photo was induced to spin her web onto a spool device as shown above. All insects are so quirk in their movements—as well as temperamental—that by the time the camera man gets to clicking away the whole show may have passed. This difficulty was overcome in the new apparatus by making its starting and stopping practically instantaneous. The operator, of course, must necessarily be at his post constantly, waiting for the royal insect play to start.



IT has long been known that the lower forms of life were much stronger in relation to their size than the human race or the larger vertebrates. Here is shown a common ant, such as the pedestrian might kill without the slightest knowledge of his act. The ant, however, in fighting his own kind or others of the lower world of life is a giant greater than any of those in the tales of the justly famous Jack the Giant Killer. The ant caught in this photo is holding with her mandibles a miniature telephone pole weighing a thousand times more than herself. A man to be equally strong would have to lift three railroad cars of coal, one on the other. In the center is shown a close-up of the ant with the cord suspending her and the cord over her mandibles on which the miniature telephone pole is tied.

ANT'S jaws are not such pleasant things to deal with, it would seem from the above close-up picture of them. The directors who got out the present film are contemplating making a picture in which the insects and men will appear in the same proportion. The insects and the men will fight—and they will be the same size. Of course, the double exposure system in printing the films will be used to make the picture.

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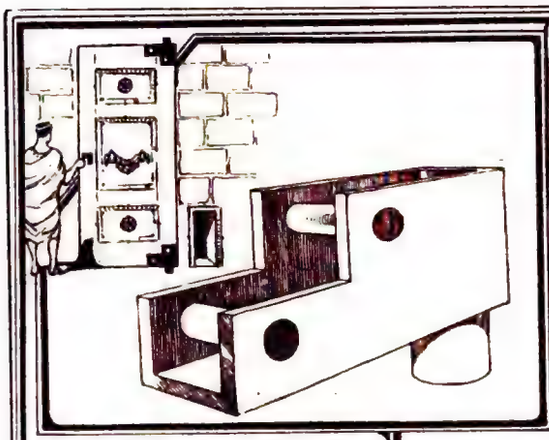
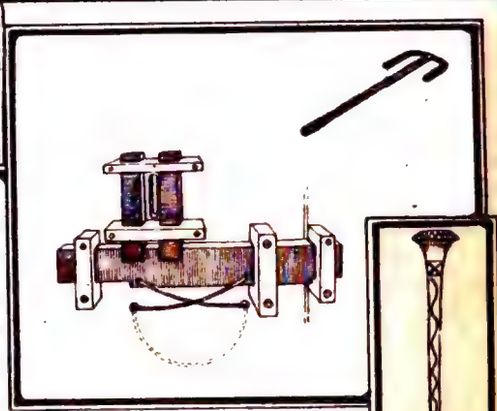
The Ancients' House Hardware

By CHARLES BEECHER BUNNELL



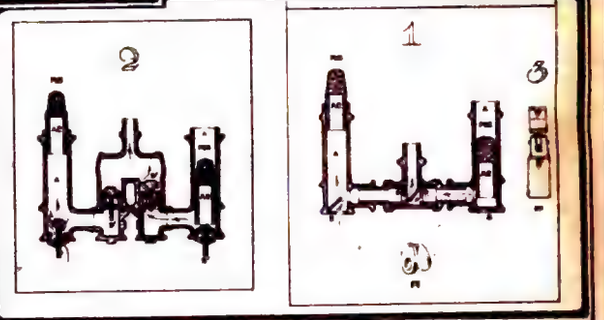
The door of the ancient Pompeians. Instead of hinges as we know them today, the richer homes used bronze key pieces with sockets. They were made of solid bronze and were made fast to the doors by rivet-like bolts through the pieces and the door. The key pieces fitted in sockets countersunk in the lintel of the door. To the right may be seen the cat and dog door.

Above is shown a lock of ancient Pompeii. The bolt of the lock was held in place by the pins. In order to open the door it was necessary to have a key with pins on its face corresponding to the perforations in the plunger. These keys dislodged the pins and took their place. By moving it ninety degrees the plunger of the lock could be withdrawn, releasing the door.



Here is the lock spoken of by Homer in his Odyssey when he tells of one Penelope having inserted a pin and raised the two plungers which held the lock in place. The plunger that held the door fast is plainly seen in the sketch. The two pins that fit into the top of the plunger held it fast when the occupants of the house were absent. These pins were held in their slots in the bolt by gravity. The above illustration, as most of the others on the page are made from pieces of apparatus now preserved in the British Museum in London.

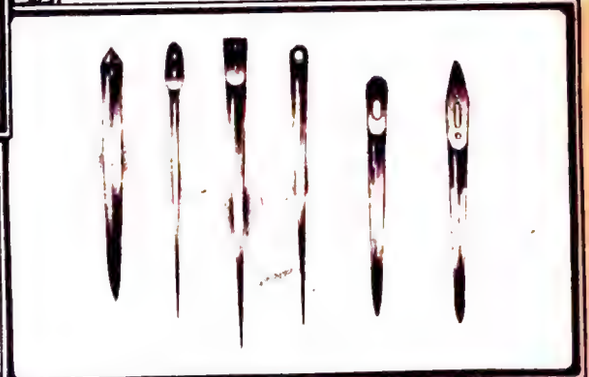
That the Romans were very fond of honey is shown by the fact that they made such elaborate bee-hives to be placed in their gardens. Above is shown one made completely of bronze, with inlay work. It will be seen that it was made in stories and had ventilators at the top. (Marked "V".) and a pan of water shown at "W"



A complete pump with valves and plungers 2,203 years old! These two pumps, shown in the above sketch were found on the site of the ancient Etruscan city of Velsunna, which was captured and entirely destroyed by the Romans in 280 B. C. The pumps were found by scientists of the British Museum. In the case of both pumps the plungers were operated by rocker arms. It will be noted that the design of the pistons is practically the same in both cases and that the only difference in the two is in the valves. It is generally conceded that the one with the flap valves is the older. In the latter pump the delivery chamber is also much more elaborate.

Alexander the ancient and glorious Monarch used the above disk with its raised letters as a means of rapid communication. The disk with its message was put into a catapult and thrown. In this case its general name forms the inscription.

We of the modern day prate about the multitude of our new inventions many of which are simply adaptations of earlier ones that flourished thousands of years ago. The fireless cooker is thought by many to be new. That it is not is shown above; it is nothing other than a form of the cooker that was used in ancient Rome.



Has the sewing needle fallen from its high estate? Here are needles of the First Roman Empire, wrought in gold, bronze and silver with inlay work in some cases. Before they were made in metal the same shapes were made in bone.

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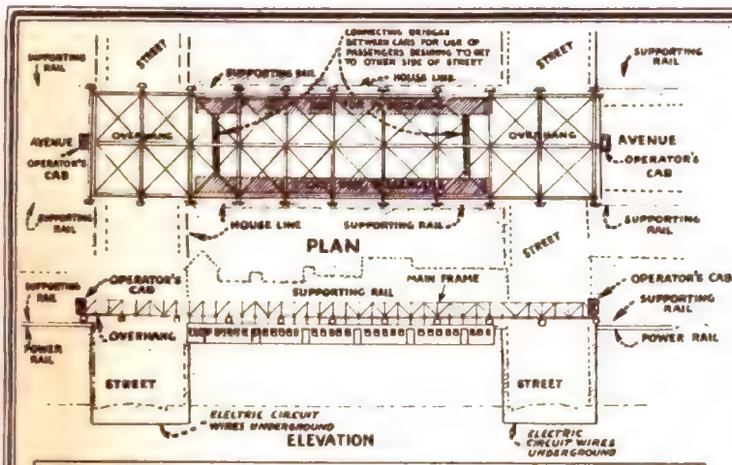
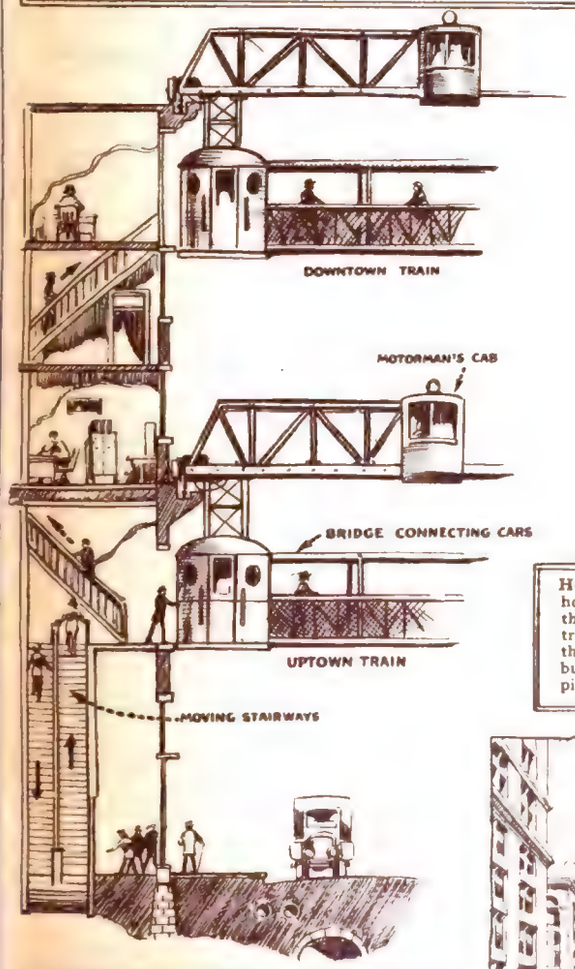
Invisible Elevated Railway

Carrying Structure in Buildings at Side of Street.

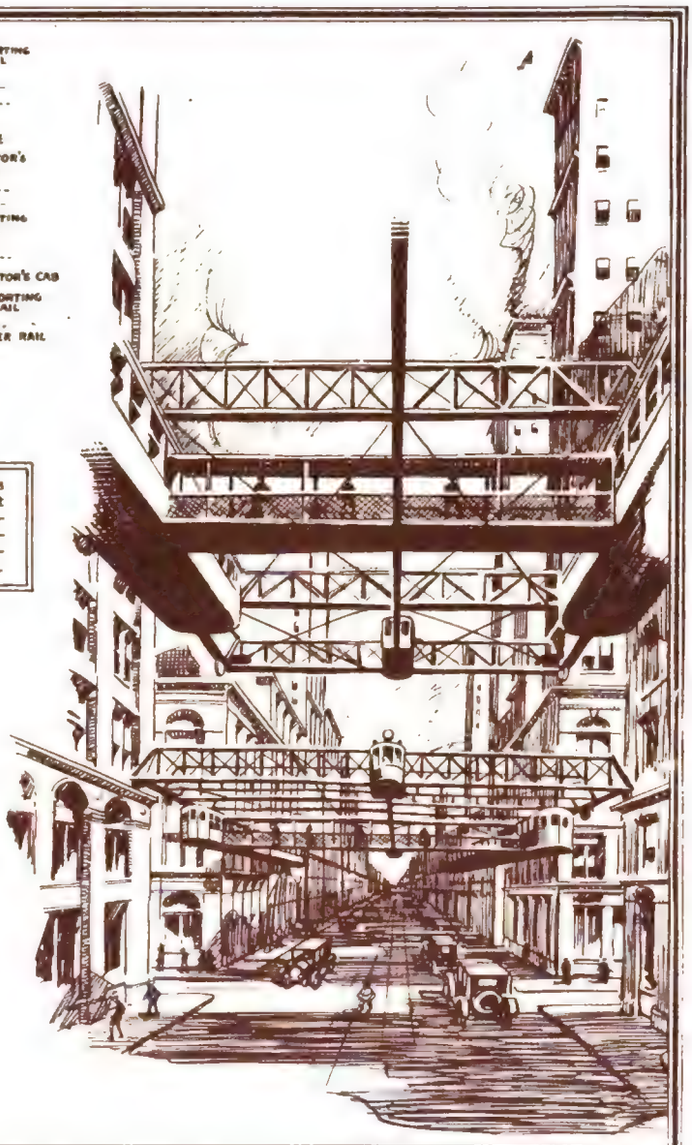
BY EDWIN F. LINDER



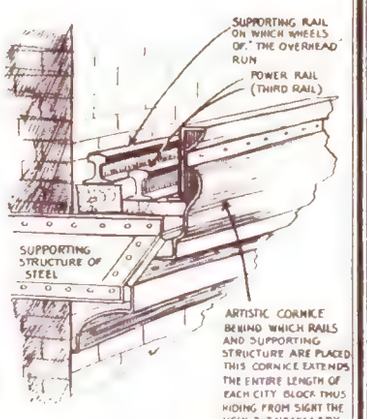
A plan view of the new idea in elevated railroads. The supporting rails are built into and supported by the steel work of the buildings that line the street. Cornices cover them from view. The trains are supported on a long, rigid framework that carries them over the street crossings without additional supporting bridge work. The overhanging running frame is extended at each end enough to cross the street gaps.



The stairways to and from the trains are also housed in the buildings at the side of the streets. The trains in one direction will run on one level and those in the other direction will run on the level above. The passenger cars will be suspended below the carrier framework on both sides near the houses. Gangways will connect the cars in the center. Passengers can board cars from both sides.



How trains running in opposite directions will look approaching each other. Note how the carrying structure protrudes in the front of the train to carry it over the street crossings. Below at the left is a view of the same street after the trains have passed. Below at the right is a close-up of the arrangement of the carrying and power rails resting on beams hidden within the walls of the buildings, thus leaving the street clear of the unsightly net of iron work and pillars that are used today to support the trains. Service will also be faster.


SUPPORTING RAIL ON WHICH WHEELS OF THE OVERHEAD RUN
POWER RAIL (THIRD RAIL)
SUPPORTING STRUCTURE OF STEEL
ARTISTIC CORNICE BEHIND WHICH RAILS AND SUPPORTING STRUCTURE ARE PLACED THIS CORNICE EXTENDS THE ENTIRE LENGTH OF EACH CITY BLOCK THUS HIDING FROM SIGHT THE UGLY BUT NECESSARY STRUCTURE

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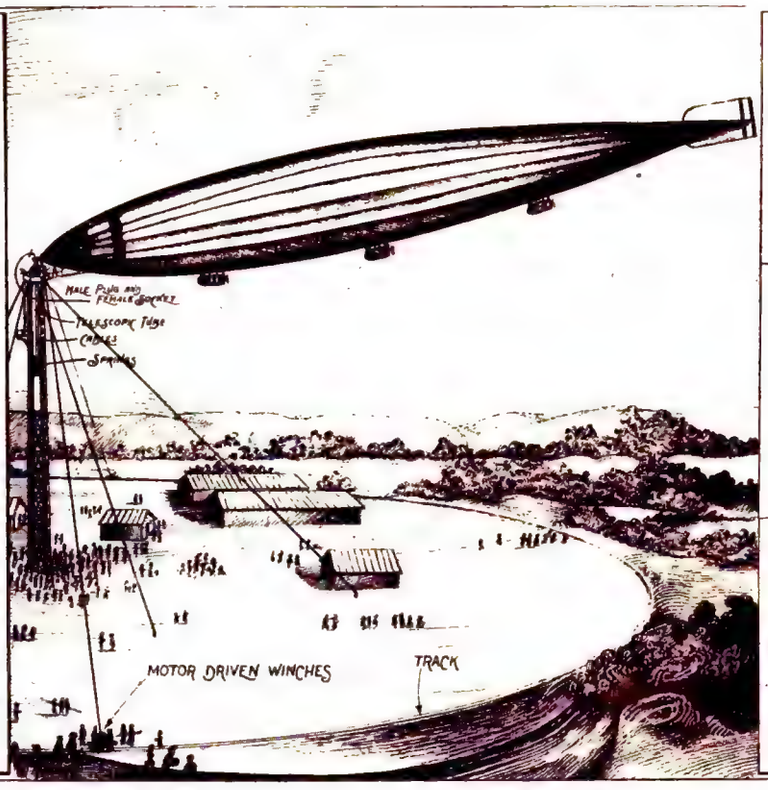
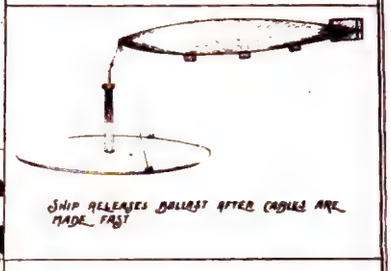
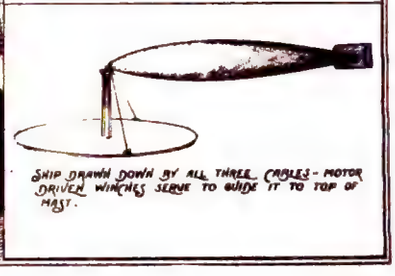
Mooring Mast for Dirigible

Tower Station Without Landing Field Allows Aircraft to Stop For Passengers

By means of a 200-foot tower German air lines now make stops where there is no landing field. A cable is thrown from the top of the tower to the ground. The dirigible slows down and casts three cables to the ground. One of its cables and the tower cable are made fast and the dirigible's nose is brought to the head of the mast and tied. Passengers embark and leave through a gangway from the top of the mast to the cars on the airship. The two extra cables thrown out by the ship merely help in placing it. On leaving the ship is simply loosed from its moorings and allowed to rise above the mast after which it starts on its journey.







$12,000 or More in Gold

Beginning with the January issue, SCIENCE AND INVENTION will pay $1,000.00 or more each month of the year in prizes. Every article published in the regular news section will receive one of them. (The departments have awards of their own which they will continue to give.)

Ideas are what the editors want. They must be told simply—so your mother or sister can understand them—in pictures and sketches. Be sure they are NEW and have something to do with science or invention. The editors want pictures and sketches—

88 monthly prizes will be given as follows:

FIRST PRIZE			$100.00
2	PRIZES	of	$50.00 each
10	"	"	25.00 "
5	"	"	20.00 "
10	"	"	15.00 "
20	"	"	10.00 "
10	"	"	5.00 "
20	"	"	2.00 "
10	"	"	1.00 "

$12,000 or More in Gold

must have them—but ideas are wanted most of all.—And they will be handsomely paid for. The rules of the contest will be found on page 534 of the October issue. If you haven't a copy, one will be mailed you free on receipt of your name and address. It will give full details of the rules and hints on submitting articles. The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of December for the February number; the 15th of January for the March number, etc.

WILL YOU BE OUR REPORTER?

IN connection with our $12,000.00 prize contest announced last month, it goes without saying that you will have to hustle to win a prize. The Editors do not wish to make it hard for you; quite the contrary. We want the pictures and want them badly. Herewith is reproduced our reporter's card. We shall be glad to send it to anyone who makes an application. By means of this card, you will be able to secure entré into industrial plants, business houses, motion picture studios, steamships, mines, etc. This card will prove an open sesame to you in many instances. Each card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary for obtaining one. It will be sent you by return mail. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.

REPORTER

Science and Invention

CORRESPONDENT REPORTER'S IDENTIFICATION NO. 999

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EXPERIMENTER PUBLISHING CO.

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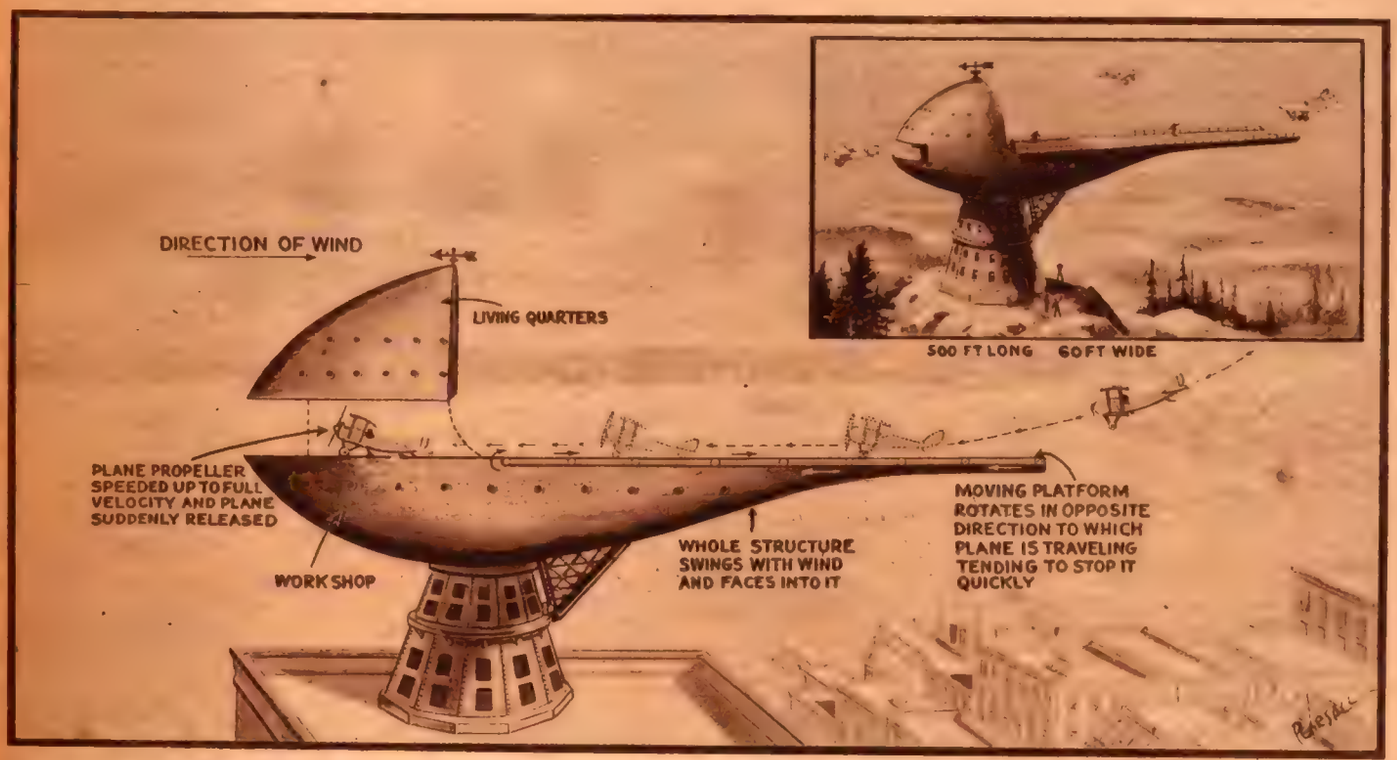
Airplane Landing Stage

By GEORGE F. PAUL


DIRECTION OF WIND
LIVING QUARTERS
500 FT LONG 60FT WIDE
PLANE PROPELLER SPEEDED UP TO FULL VELOCITY AND PLANE SUDDENLY RELEASED
WORK SHOP
WHOLE STRUCTURE SWINGS WITH WIND AND FACES INTO IT
MOVING PLATFORM ROTATES IN OPPOSITE DIRECTION TO WHICH PLANE IS TRAVELING TENDING TO STOP IT QUICKLY

The new landing stage shown in the above drawing can be constructed anywhere, regardless of physical conditions surrounding it. It will accommodate landing in any weather and allows planes to hop off without a runway. The structure is of fabricated steel and automatically faces itself into the wind.

Safety Gas Mask for Miners

The gas mask shown above was found to be very effective against poisonous mine gases. Ordinarily it is carried in the small metal container shown at left. For use the miner clamps tips over his nose and grips mouthpiece with his teeth. The perforated box contains hopcalite which counteracts carbon monoxide, the most deadly of mine gases. The chemicals will give relief for seventy minutes, allowing miner time to reach safety.—John M. Schalek

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POPULAR

BY IŞABEL

OF THE U. S.

THE WONDERS

A full view of the planet Saturn with its system of rings as seen through a large telescope. The thickness of the planet and the rings from outer edge to outer edge is about 172,500 miles. The diameter of the planet itself is 76,460 miles at the equator. The first ring's inner edge is 5,900 miles from the surface of the planet. The first, or dusky ring itself is 10,900 miles in diameter. Very little is known as to the composition of the rings. It is said, however, that some of the particles in them may be as large as three miles in diameter while it is entirely possible that they may be composed of gaseous clouds. It is thought that the particles are the thickest at the outer edge of the second ring. Also, some think that the rings may be composed of large masses of dust particles.

This is as the rings would appear to visitors of the planet on a Winter's mid-day were they in Latitude fifty degrees North. The gap between the second and third rings now becomes an area of light through which the sun filters since it is on the opposite side of the rings from the observer. Here, though it is mid-day stars can be seen above the rings at all times. In these latitudes there is only a small segment of the first ring visible above the horizon. Of course, the sun being on the opposite side of the rings from the northern surface of the planet, that part of its surface is in darkness, or semi-darkness, most of the time. If the rings are composed of dust particles, as some think, it is thick enough to obscure the sun. Some think that the rings are composed of gaseous clouds.

Google

ASTRONOMY

M. LEWIS, M. A.
NAVAL OBSERVATORY

As the rings of Saturn would appear to an observer on the planet were he standing at a point thirty-five degrees North Latitude at midnight in mid-summer. An awe-inspiring sight. The Saturn seasons are seven and one-half years long. The large black ellipse in the center of the rings is the shadow cast on them by the planet itself. The three rings are distinct. The dull inner ring, sometimes known as the "crepe" ring, is followed by the bright middle ring. Between the middle and outer rings is a dark gap known as Cassini's Division. The rings are thought to be about one hundred miles in thickness. For about three years at a stretch the shadow of the planet passes all three rings as shown in the drawing. An exception to this is near the Summer Solstice.

This will give an idea of how the rings look to the inhabitants of the planet who live near its equator, shortly after sunset at the planet's Vernal Equinox. As those who live at the equator are in the plane of the rings they see only the edge of them. At the lower left corner of the picture may be seen the shadow of the planet rising on the rings and gradually extinguishing them from view. This arch would seem about twice the thickness of the full moon at the zenith and would taper off about one-third of that thickness at the ends near the horizon. In this picture the sun is just below the horizon at the right side of the picture. Saturn's Spring and Autumn are fifteen years apart.

(CONTINUED ON PAGE 817)

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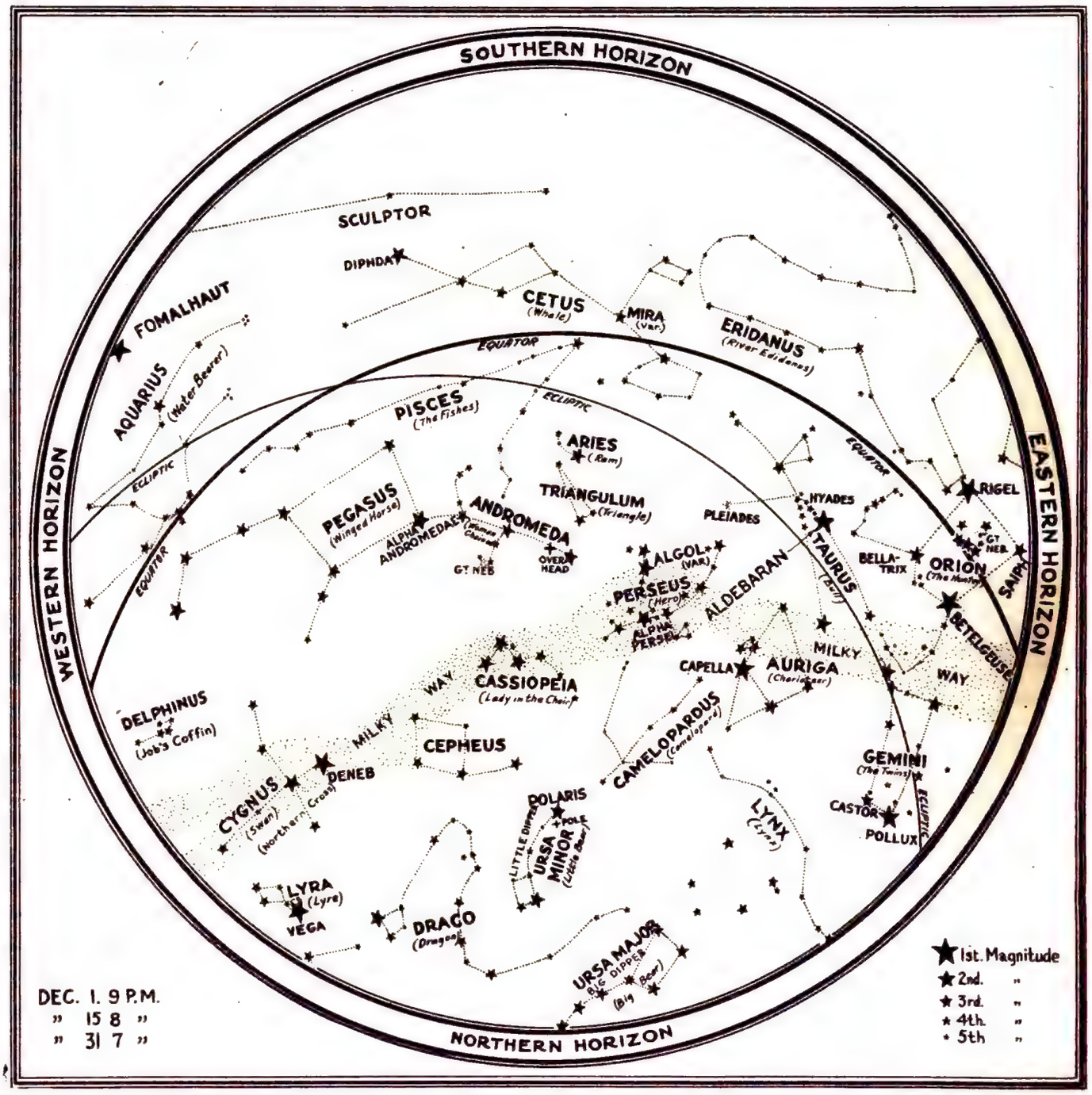
The Heavens in December

By ISABEL M. LEWIS, M.A.
of the U. S. Naval Observatory



Above is the star map for the month of December. If the chart is held over the head with the "Northern Horizon," north, at nine P. M. December first or eight P. M. December fifteenth the location of the stars in the heavens will coincide with their position on the map.

THE leaders of the brilliant constellations of winter, Taurus, The Bull, containing the famous clusters of the Pleiades and the Hyades; and Auriga, The Charioteer, with its beautiful Capella and The Kids, or Haedi, close by. Aldebaran, the fiery, red star that marks the eye of the Bull in the v-shaped group of the Hyades is estimated to be about fifty light years from the earth. It is, therefore, one of the nearer stars and it is also one of the giants of the universe for, according to reliable estimates, its diameter is in excess of 30,000,000 miles. It is equal in bulk to more than sixty thousand suns as large as our own. Its surface temperature is about the sun spot regions of our own sun or approximately 3,500 degrees. Very few of the luminous stars in the heavens have surface temperature below 3,000 degrees.

Capella is also one of the nearer stars. Its distance is approximately 52 light years. Though it is a star of the same type as the sun its diameter is estimated to be nearly ten times as great, or over 8,000,000 miles. The meaning of the word Capella is she-goat and the small group of stars of the fourth magnitude nearby are known as "Haedi" or The Kids.

The magnificent constellation of Orion with its two stars of first magnitude, Rigel and Betelgeuse, and its distinctive belt of three evenly spaced stars of the second magnitude is now visible in the southeast. Also the well-known constellation of Gemini with its twin stars Castor and Pollux.

Perseus has now come conspicuously into view. At the time indicated on the chart, it will be found just to the east of the meridian. One of the richest fields of the Milky Way abounding in nebulae clusters and double stars is to be found in this constellation. Algol, The Demon Star, which ordinarily is of the second magnitude, but which suddenly every third day drops to the third magnitude within a brief period of three and a half hours, and then within an

(*Continued on page* 809)

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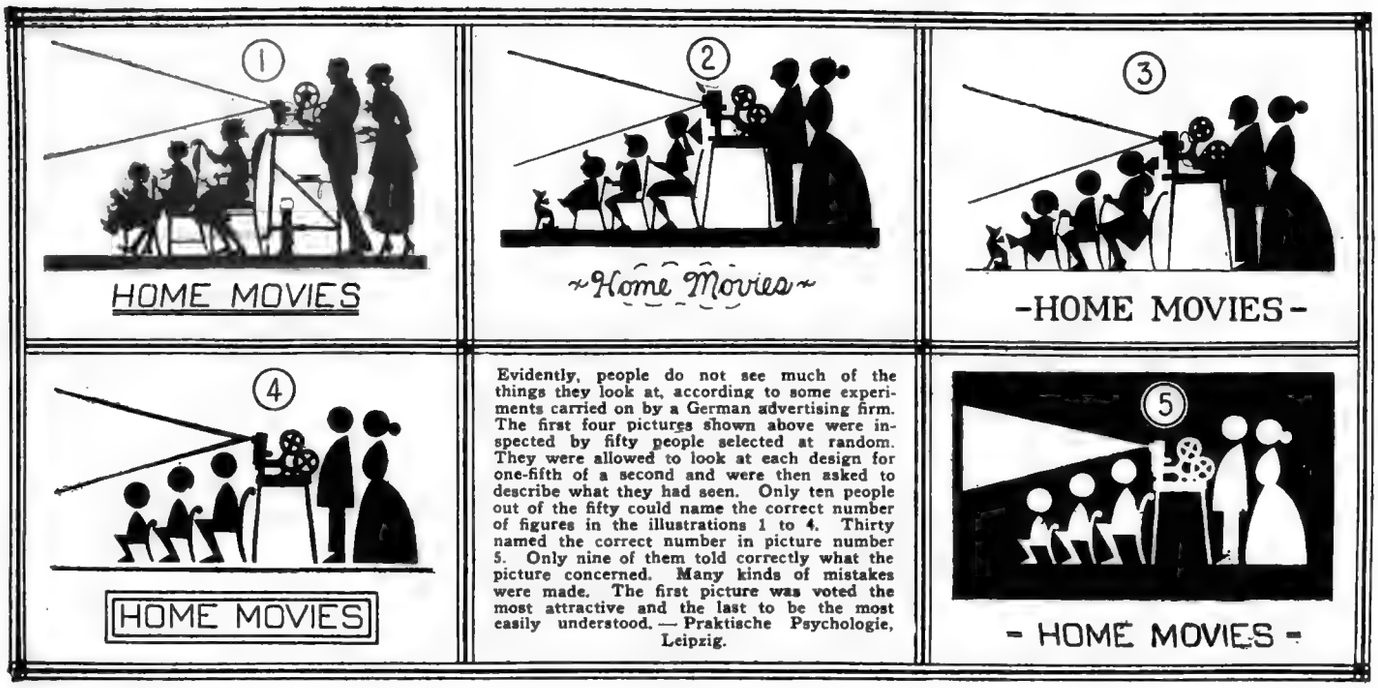
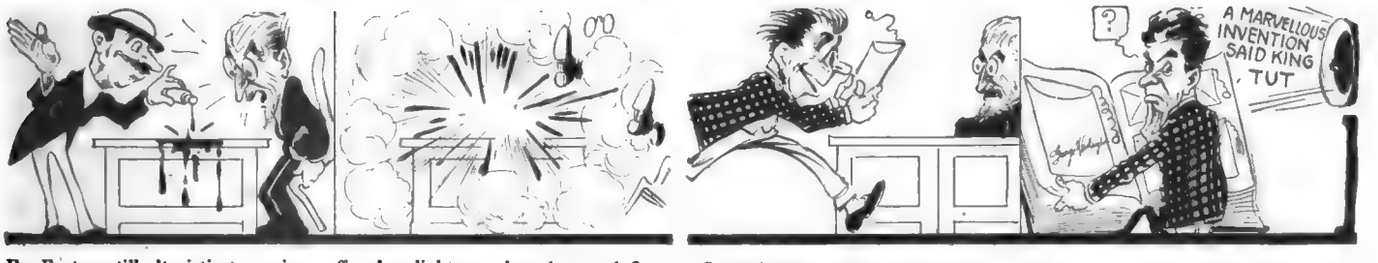
Do You See What You Look At?



Evidently, people do not see much of the things they look at, according to some experiments carried on by a German advertising firm. The first four pictures shown above were inspected by fifty people selected at random. They were allowed to look at each design for one-fifth of a second and were then asked to describe what they had seen. Only ten people out of the fifty could name the correct number of figures in the illustrations 1 to 4. Thirty named the correct number in picture number 5. Only nine of them told correctly what the picture concerned. Many kinds of mistakes were made. The first picture was voted the most attractive and the last to be the most easily understood. — Praktische Psychologie, Leipzig.

Trying It On the Patent Lawyer

A lot of inventive genius is inventive bunk, according to Franklin J. Foster, who, after many years of helping struggling geniuses, was forced to retire or be retired by the genius he was helping. He said he knew from his interview with his first client that matters would come to just such a pass. His shingle was bright and new when the budding young genius asked advice on a safety pin. The doctor of laws obtained a small fee and a split thumb for his trouble. Another genius was going to do away with writing messages for carrier pigeons by crossing them with parrots so they could speak the message.



Dr. Foster, still altruistic to genius, suffered a slight surprise when an inflammable furniture polish took the mahogany off his desk-top, removed his eye lashes and was finally subdued only with the aid of the city fire department.

Inventing envelopes with wires or strings to tear the flaps is a form of insanity, he thinks. He uses a phonograph to tell the inventors when the first one appeared and shows them 79 like patents autographed by G. Washington.

He was about to do the God of War a service when the inventor of the device mistook the doctor's zeal for interest, and turned the thing on. Foster did the round of his office thirty-seven times in just slightly over nothing flat. The rotating machine gun, it might be added, did the same rotation as the doctor in just slightly less time. This pleasant little incident was one of the outstanding reasons for his retirement from nursing impecunious inventors—this and the fact that he hated to speak about such trifles as fees and that the inventors chronically suffered a lapse of memory concerning them.

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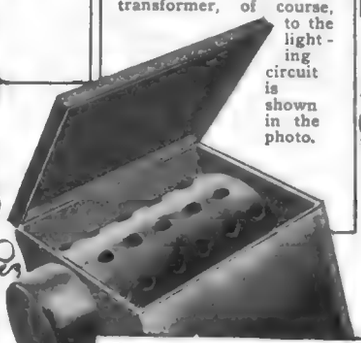
Scientific Gifts for the Children

The Engineers and Shops of Santa Claus

AT the Yuletide all men and things unite and bend their efforts toward peace and goodwill. Here are the offerings of the shops, ingenious engineers and clever designers, built to give joy to the hearts of thousands of kiddies—and the grown-ups—in celebration of the great and wonderful spirit that grows out of the celebration of the birthday of the world's most wonderful hero.

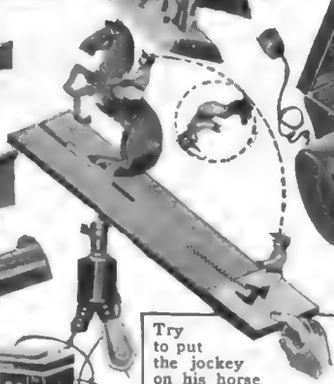
This pair of electric racing cars started by the sound of the voice or a clap of the hands will furnish sport for many a long winter's evening. The cars are pulled to the top of the plane where a catch holds them in place before starting.

For the embryo housekeeper. An electric washing machine made just like its life-size model. It has the motor below the tub, the rotor in the tub, the spigot on the side, and everything. The plug attachment for connecting the machine, through a low voltage transformer, of course, to the lighting circuit is shown in the photo.



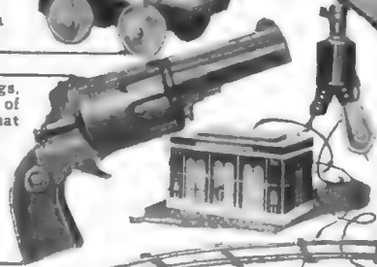
Quite the de luxe in tops is shown here. On the top of the body is an arrangement that throws out great bursts of harmless sparks as the top spins. It is started like most other mechanical tops with a special spring device that winds up on the spindle. It also emits a deep humming note.

"The trolley, the Toonerville trolley, the trolley that meets all the trains." Here it is with its wheels off center and the driver ever working the brakes — all operated by a spring motor, going through antics more ridiculous than even the cartoon makes it.



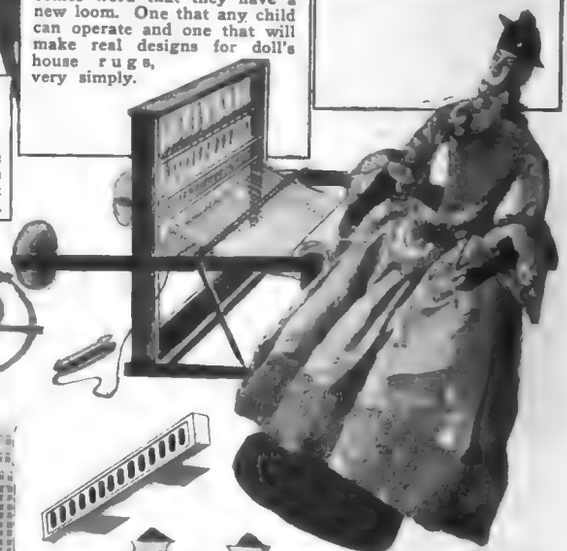
Below, in the doll shown, we hark back to the days of the First Napoleon. A Dresden doll of the early Eighteenth century.

A real gun that bangs, shoots out a tongue of flame and, does all that a gun should do and yet is harmless. The secret is, it works with a chemical and water. It shoots several times on one charge and sells for fifty cents.

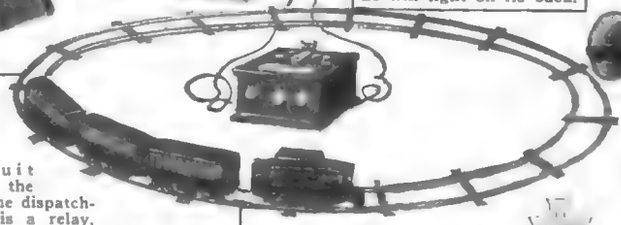


Try to put the jockey on his horse. Release the board on which he stands and then move the horse so that he will light on its back.

From a leading toy concern comes word that they have a new loom. One that any child can operate and one that will make real designs for doll's house rugs, very simply.



This train must be dispatched. It stops and starts with a sound of the voice. Connected to the lighting circuit through a transformer the current passes through the dispatcher's office where there is a relay, sound operated, that acts on the same principle as the Radio Rex toy. When the child speaks the circuit is made or broken and the train stops or starts.



Here is a toy that will thrill the heart of the future builder of sky-scrapers. Made of tin, the window, door, archway, cornice and wall pieces can be put together to form a perfect replica of the world's most famous buildings. There are two different designs of windows, three of doors and a number of cornice, balcony and roof designs. At all four of the edges of the pieces there are slits where thin friction plates are inserted and the next piece put on. There are also plain structural steel imitation pieces for building bridges, towers or other such structures. The pieces are a little more than two inches square. Twelve of them make a building more than two feet high! A real sky-scraper for the children. Designs for a large number of buildings are furnished with each

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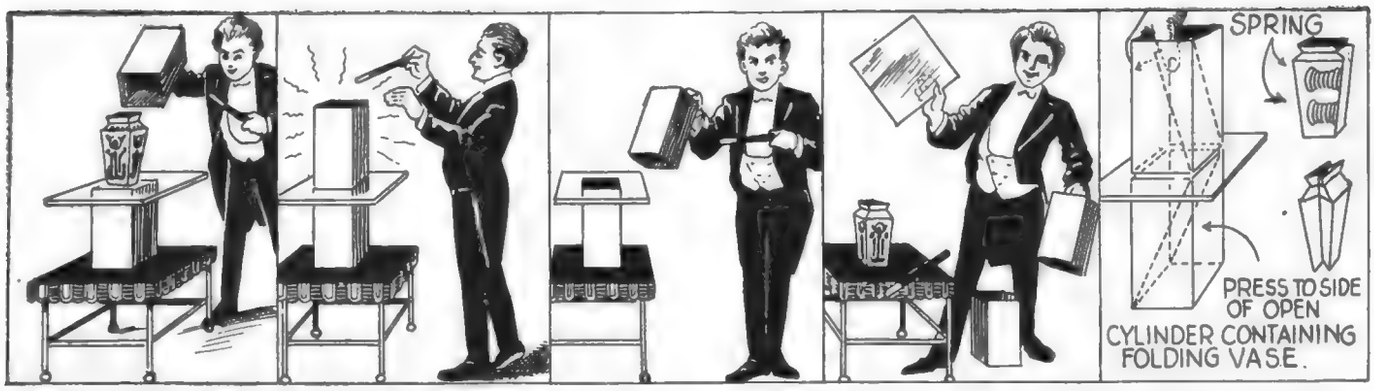
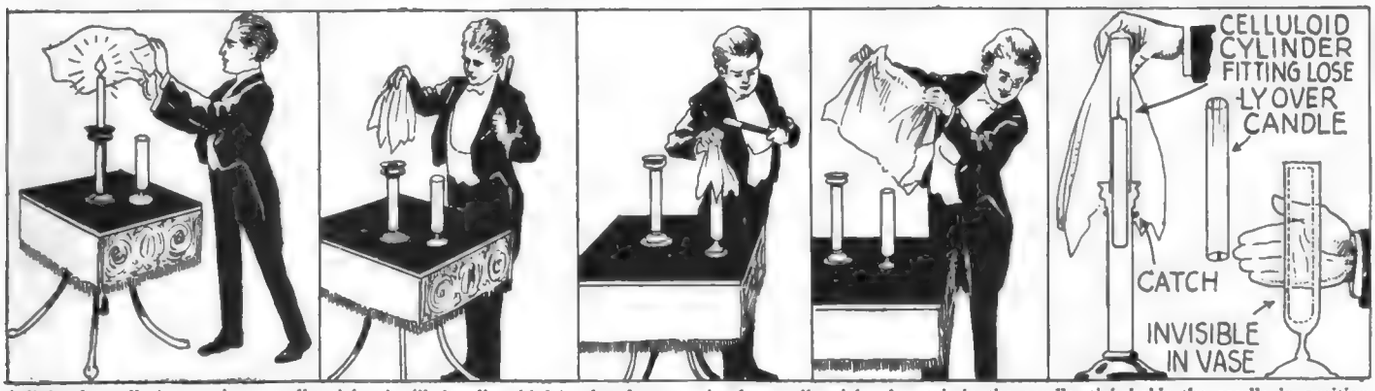
Magic for Everybody

By PROF. JOSEPH DUNNINGER

NO. 9 OF A SERIES

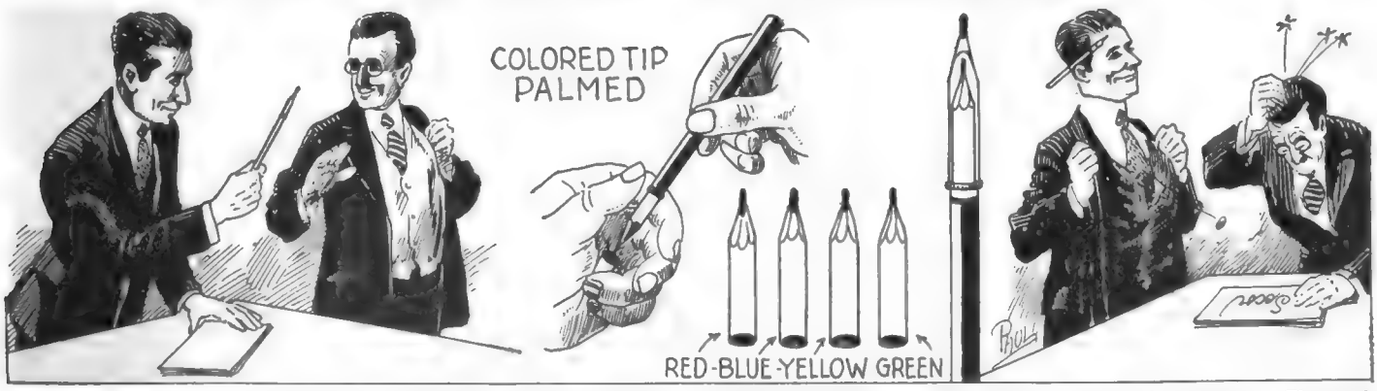


A wooden box open at both ends is shown to the audience and then placed upon a table. The open top is then covered with plate glass sheets. A vase is placed on the glass. This vase is covered with a duplicate box. A moment later the top box is removed and the vase has disappeared. The plate glass is taken away and the bottom box is picked up. The vase is found on the table. The boxes are made with a flap while the vases are of cloth opened by springs. When it is desired to disappear one of them, the wooden leaf is pressed to one side, folding and concealing the vase.



A lighted candle is seen in a candle-stick. A silk handkerchief is placed over it. The candle, whose shape can be easily seen beneath the handkerchief, is put into a tall glass. Snapping the kerchief away, it will be found that the candle has completely disappeared. A celluloid tube surrounds the candle in the candle-stick. A catch in the candle-stick holds the candle in position. When the magician covers the candle he releases the catch, permitting the tallow taper to slide into the candle-stick. The celluloid cylinder is removed and placed in a glass vase, where it is invisible.

Although not a magical trick, the above novelty if constructed, will repay the slight amount of work required. When one sees a choice box of cigars open and no one else looking, he will undoubtedly step over, extract one and then take a match. He strikes a match on the box, and then with a sudden snap the entire contents of the match box fly all over the table and floor. The construction of the device is made clear in the diagram. The side of the match box is hinged so that a catch on the bottom will be released when the striking surface is touched.



The magician passes an ordinary pencil to his audience for examination and tells them that the pencil will write in colors, and asks them to name a color in which he desires the writing to appear. One of the audience says "green." Grasping the pencil he writes a name in the chosen color on a sheet of paper and then returns the pencil and paper to the spectators. The magician has a series of colored crayon pencil-tips resembling the end of the regular pencil. The tip of the color requested is palmed, and when the pencil is returned to the magician the tip is put on the end.

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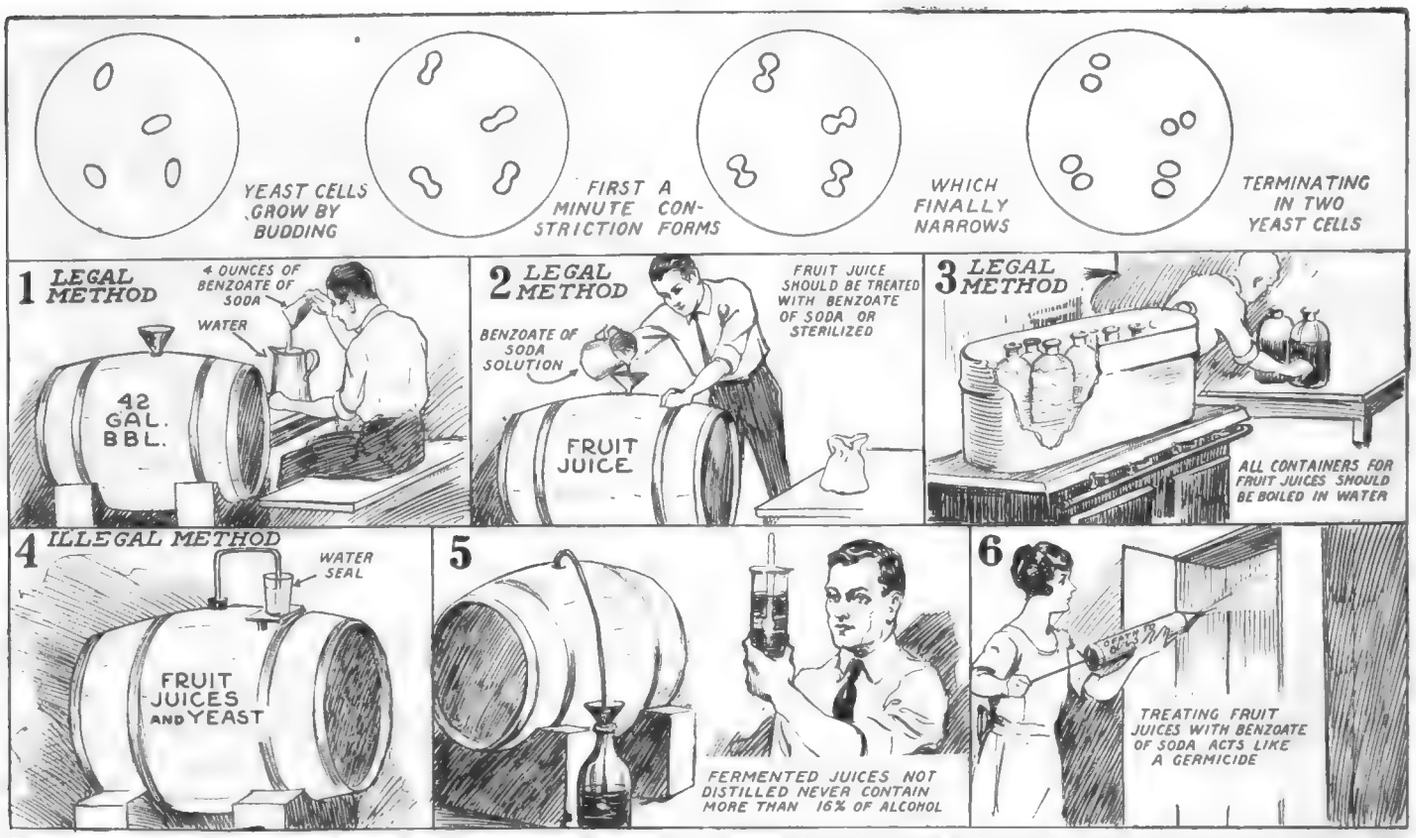
"Kick" Prevention for Cider

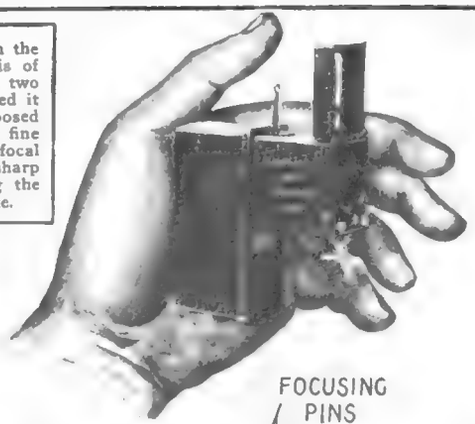
By RAYMOND B. WAILES.

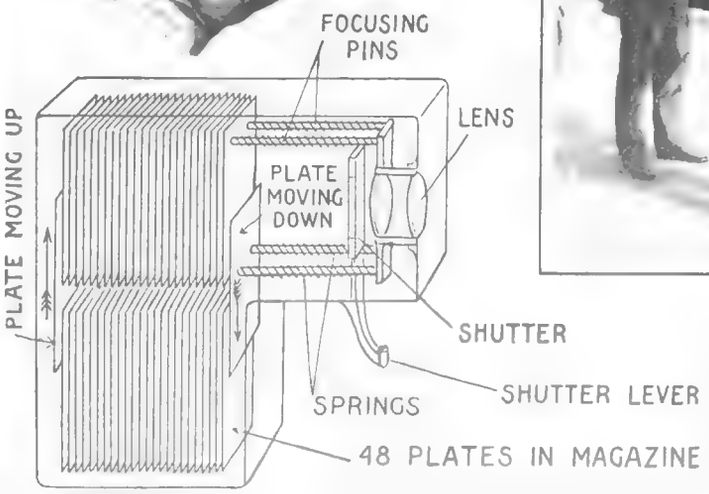

YEAST CELLS GROW BY BUDDING
FIRST A MINUTE CONSTRICTION FORMS
WHICH FINALLY NARROWS
TERMINATING IN TWO YEAST CELLS
1 LEGAL METHOD
4 OUNCES OF BENZOATE OF SODA
WATER
42 GAL. BBL.
2 LEGAL METHOD
BENZOATE OF SODA SOLUTION
FRUIT JUICE
FRUIT JUICE SHOULD BE TREATED WITH BENZOATE OF SODA OR STERILIZED
3 LEGAL METHOD
ALL CONTAINERS FOR FRUIT JUICES SHOULD BE BOILED IN WATER
4 ILLEGAL METHOD
WATER SEAL
FRUIT JUICES AND YEAST
5
FERMENTED JUICES NOT DISTILLED NEVER CONTAIN MORE THAN 16% OF ALCOHOL
6
TREATING FRUIT JUICES WITH BENZOATE OF SODA ACTS LIKE A GERMICIDE

To prevent souring and fermenting in cider, add four ounces of benzoate of soda dissolved in water to a barrel. Another method is to sterilize the containers by boiling and pouring the hot juice into them and corking immediately. The water seal method is illegal since after fermentation has started the seal prevents it from going further into the vinegar stage. The sketches at the top of the page show how the yeast cells grow by becoming narrow and splitting into two parts. The benzoate of soda acts as a germicide and kills them. This information is of value just now.

World's Smallest Multi-plate Camera

This small camera that can easily be concealed in the palm of the hand holds forty-eight plates. It is of French manufacture. The plate magazine is in two parts, one above the other. As a plate is exposed it passes to the bottom compartment and an unexposed plate takes its place on the top row. Two very fine lenses are used, and, with the extremely short focal length of one and five-eighths inches, very sharp photos may be taken. Four focusing pins bring the lens to the proper distance from the plate.





With its smallness and the sharp pictures it makes from which quite large enlargements may be made the little camera is invaluable in police work, for taking pictures secretly. —C. A. Oldroyd.

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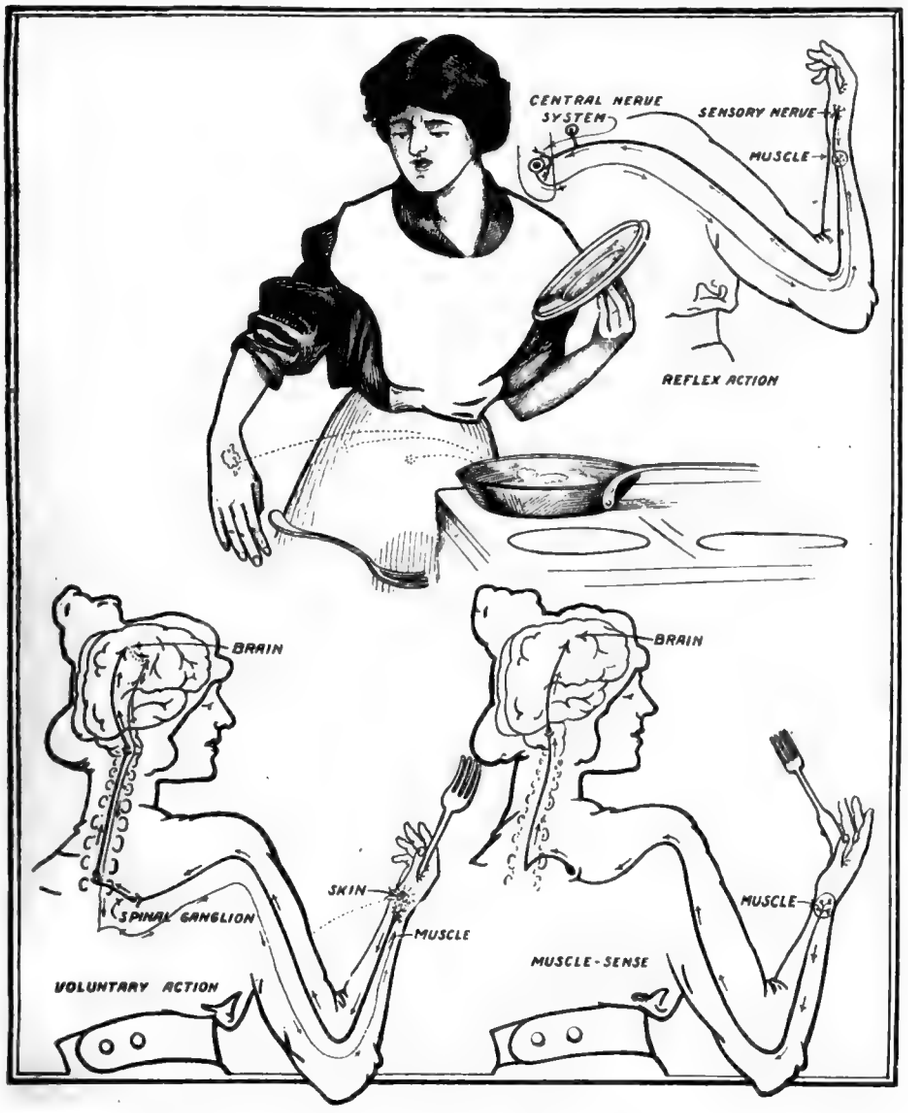
Burn Yourself? What Happens?



The illustration at the left shows graphically what happens when we burn ourselves. The burning sensation affects the sensory nerve at the spot where the hot grease falls on the arm of the woman (at the top). This sensation is carred to the central nerve system where a connection is made to a motor nerve which forces the arm to be jerked away. This happens instantly and without the knowledge of the woman. Just a fraction of a second later, however, the impulse is carried on to the brain. Following this, another nerve, the muscle sense nerve, leading from the arm tells the brain that the arm has moved. All this happens in a fraction of a second.

Electric Jack

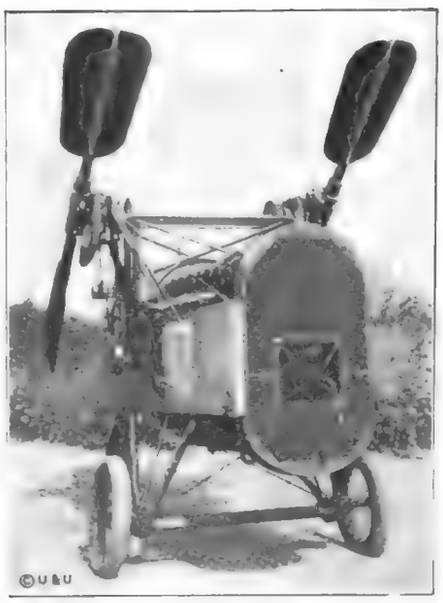
The electric power jack shown here is capable of lifting a load of 150 tons. Power is furnished by a one-half horse-power motor directly connected to a lighting circuit. The motor is connected to the jack through a series of reducing gears. The power is applied to a gear at the top of the jack-stand. All bearings thoughout are of steel ball-bearings. A brake-control is installed to take up the weight in lowering the jack. This brake works on the gears after reduction giving perfect control of the load while it is descending.

Geo A. Cosgove

License Lock

By locking a cross over the license plate while the car is parked, the all-steel apparatus shown above makes the car thief-proof.

The Omnivator



The inventor of this machine, E. R. Johnson, claims it will ascend, descend, move forward, backward, or remain stationary in the air. It will compete in the British helicopter contest.

Double Aquarium

By placing a cloth across the top of the goldfish bowl and planting it with [illegible] and seeds —a double aquarium results

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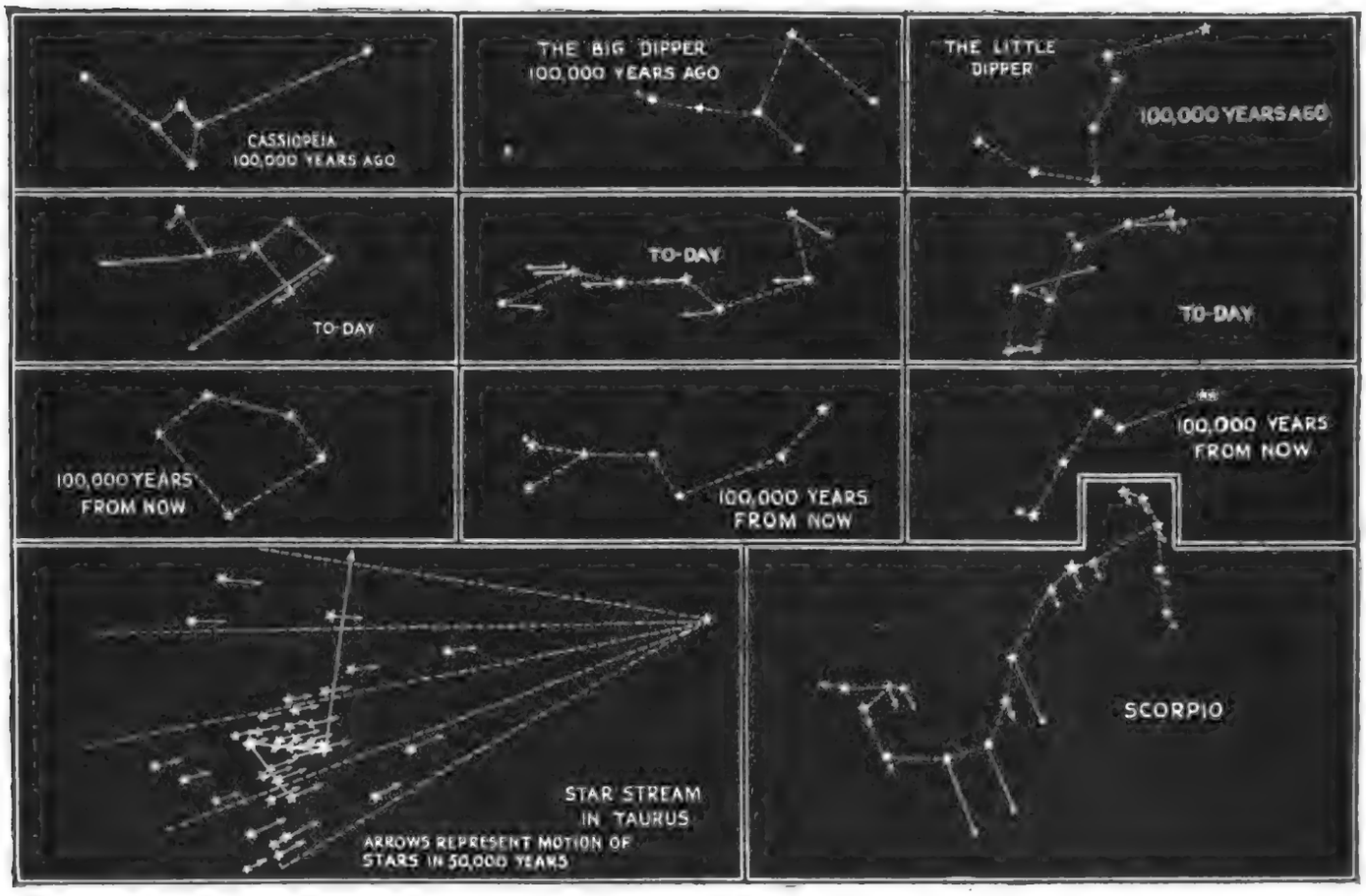
The Stars In 1000 Centuries

DONALD H. MENZEL, Princeton University



Here, with what is known of the direction and rate of travel of the stars in the major constellations, is constructed a map of what possibly will be the face of the groups of stars 1,000 centuries hence. To the astronomers of those days, the constellations in their present form will be entirely unknown. These figures will also be altered by the movement of our own solar system in relation to the constellations. Then the mariners will have to find some other star by which to set their course since Polaris is moving out of its position along with the remainder of the stars in its constellation. It is not moving as fast as some of the others but in a thousand centuries it will no longer point to the pole.

Motor Driven Sled

...l with caterpillar treads and a husky motor, the sled shown in the above illustration is capable ... its passengers over hill and dale at the rate of twenty-five to forty-five miles an hour. ... wheel at the front rests on springs and is used to steer the sled. It was shown at the Winter Carnival at Montreal, Can.

Portable Stove for Winter Sports

A very simple and useful portable skating stove that can be used with charcoal is shown in the above photo. The kettle that forms the bottom is riveted to the bucket that serves as a grate. Holes are punched through the bottom of both to admit draught. The handle of the bucket will be found very serviceable in carrying the stove.
—Dale R. Van Horn.

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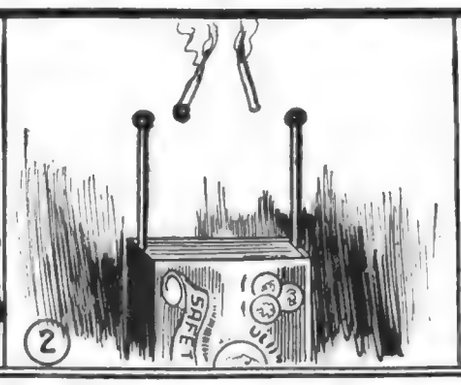
Scientific Match-box Puzzles

Several Simple Entertainments from Safety Matches

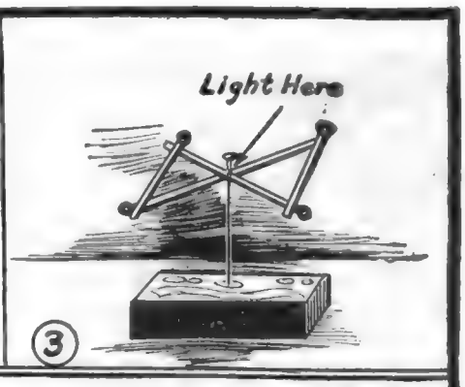
1

Place three matches as shown in the sketch above, two of them thrust in between the drawer and the sides of the box. Light the cross match in the middle and ask which will ignite first.



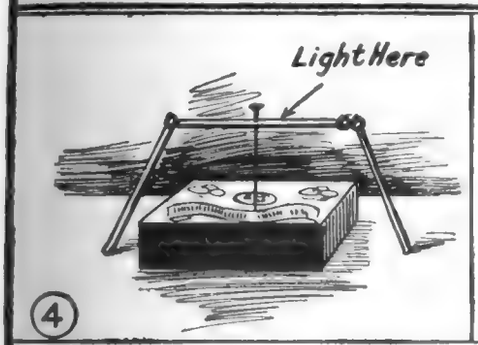
2

After all the opinions and bets are in light the central match and watch the fun. The pressure of the other two matches will throw the burning stick in the air. The others do not light.



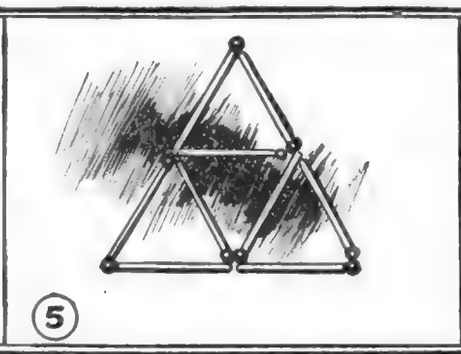
3

A simple variation of this stunt is to pin two matches in the form of a cross as shown above and lay two other matches across to ends of the cross. Light the center. The matches fall off.



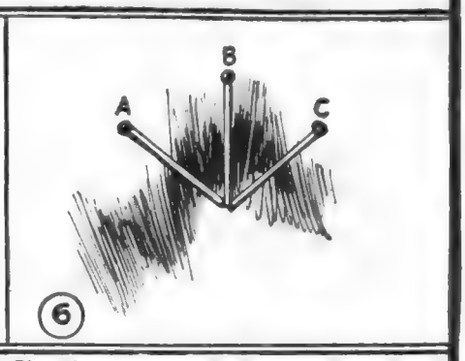
4

This is a third variation of the same stunt, shown above. Instead of the cross use only one match as the support and stand the other two at its end. They, as before, fall to safety and are not ignited. The supporting pin will become warm.



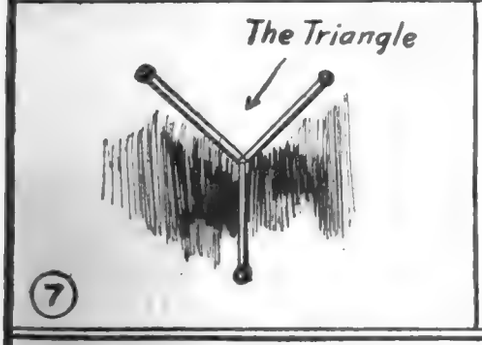
5

Ask your audience to form five triangles with nine matches. Give them the matches and let them try it. All the triangles are equilateral and none of the sticks must be broken. The solution of the puzzle is shown in the sketch.



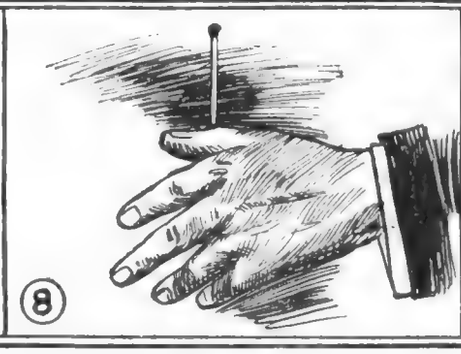
6

Place three matches in the sketch as shown above and ask someone in the crowd to form an equilateral triangle with them by moving only the match marked "B." The other two must not be moved. Be sure that the ends are square.



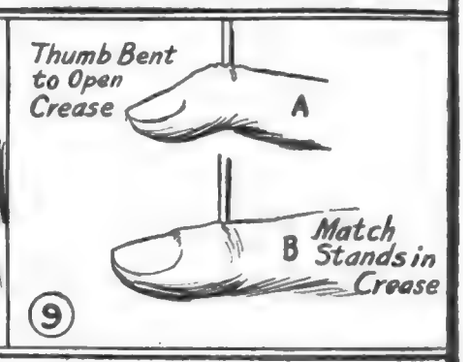
7

The solution to the problem is simple. Simply put the match "B" at the bottom of the other two and a very small equilateral triangle will be formed by the square bases of the matches as shown in the sketch.



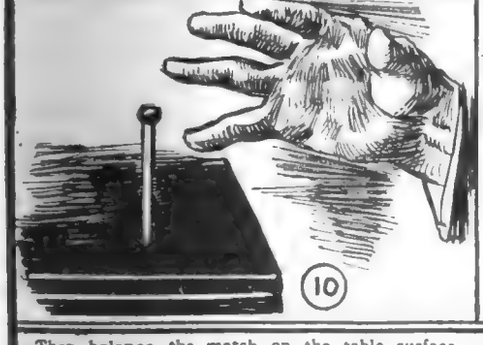
8

This is a great feat of equilibrium. Place the small match stick on the thumb and make stage play of great difficulty to keep it balanced. Unless some one knows the trick they will say you should be on the Keith Circuit.



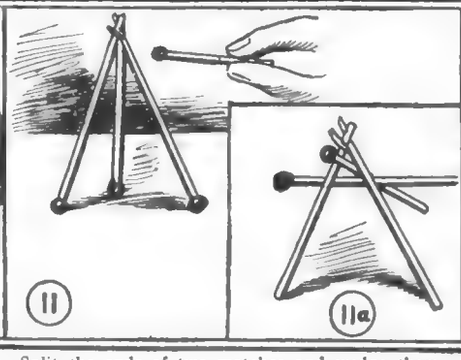
9

They will change their mind, however, when the explanation is given them. The thumb is bent down as shown in the above sketch and the match is inserted in the wrinkle of flesh where it is firmly held in the upright position.



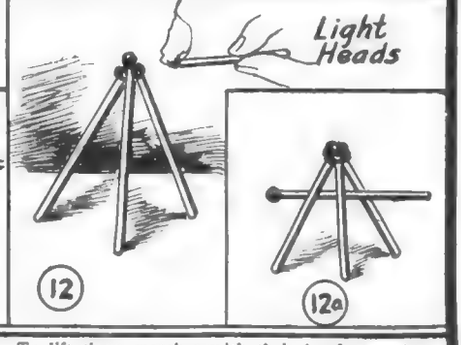
10

Then balance the match on the table surface. While the audience isn't looking moisten the end of the match. When placing it on the table use some force in standing it upright. After the feat secretly remove the moisture with the finger.



11 11a

Split the ends of two matches and wedge them together. Then place a third one next them forming the tripod as shown above. Ask someone to lift the three with one match. The solution is to let the loose match fall between the lifting stick and the two wedged ones



12 12a

To lift three matches with their heads together, light them and extinguish the flame with a breath. The heads will be found to be welded together so that they may be easily lifted from the table.

—WALTER B. GIBSON.

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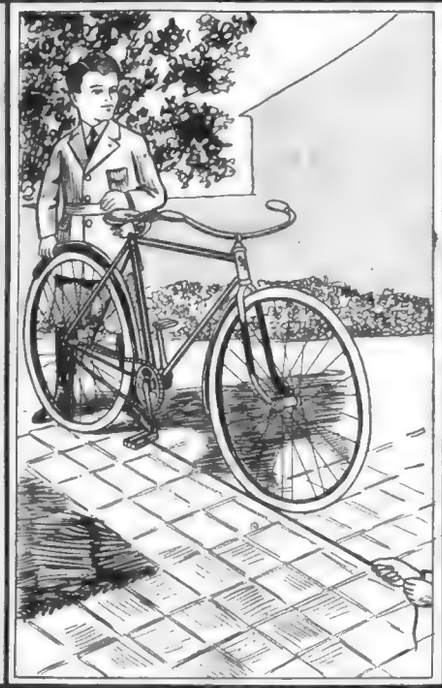
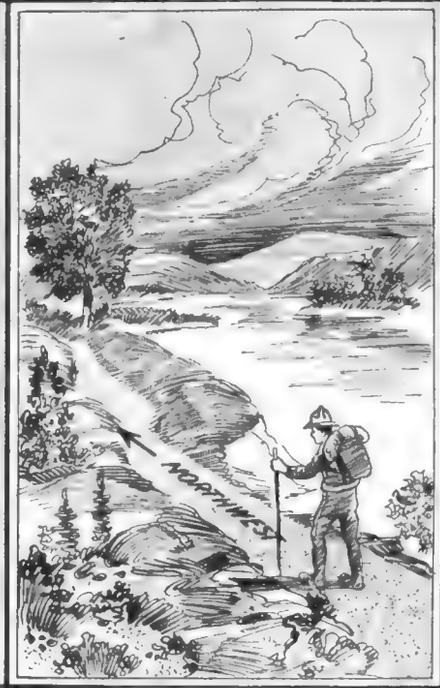
Can You Answer These Problems?

Problems of Scientific Interest Involving Well-Known General Physical Laws.

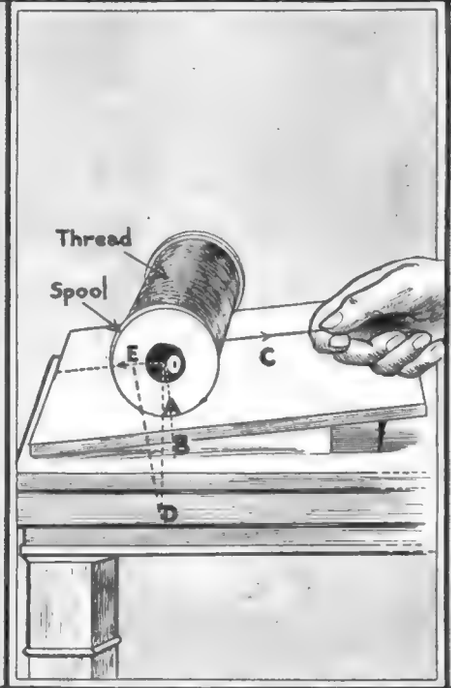
By ERNEST K. CHAPIN.



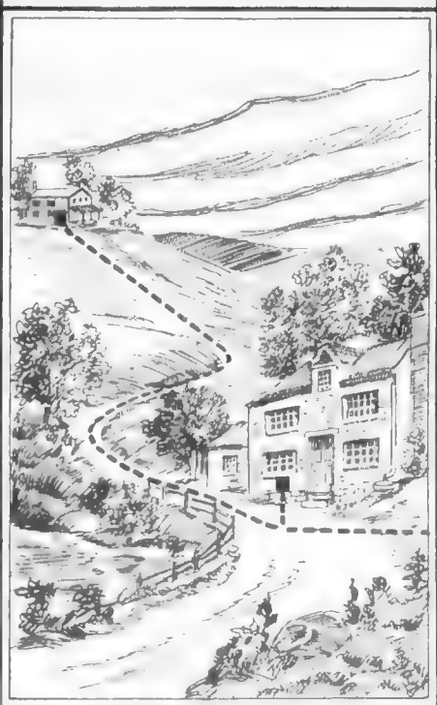
For the first problem take an ordinary bicycle. It must be without a coaster brake attachment. Set it so one of the pedals is down, as shown in the above sketch. Rest both of the wheels on the ground. Tie a rope to the pedal nearest the ground and pull it forward. Which way will the bicycle move and how far?



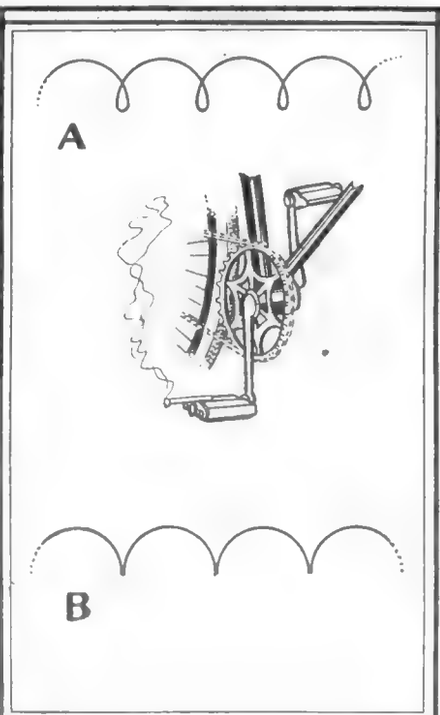
Traveling is an epidemic, it seems. Some people are pushing wheelbarrows around the continent and others are traveling the railroads—walking. Suppose someone set out to travel northwest only. Working from town to town but only going northwest. How far could the traveler go?



The rolling spool test shown in the above is a variation of the bicycle problem. Place the spool on an inclined plane and unroll one end of the thread, holding it. The end of the thread should come out from under the spool at the center. If a light spool is used better results can be obtained.



Of two houses, both taking gas from the same main, one situated at the bottom of a hill and the other at the top, which would receive the gas at the highest pressure? Would the fact that gas is lighter than air cause the most pressure at the top; or the fact that it has ht make the pressure largest at the bottom of the hill?



If a lighted cigarette were tied to the pedal of a bicycle as shown and the smoke from the cigarette remained stationary, what sort of a figure would be made by the smoke as the bicycle traveled. Of the two figures above and below the pedal in the illustration, which is right—if either of them and why?

Stand near a picket fence and, walking down beside it, clap the hands. At some spots along the fence a musical echo note will be heard. What causes this and why can it only be heard in spots?

ANSWERS ON PAGE 813

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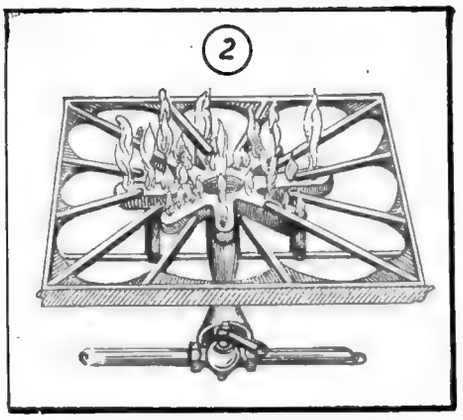
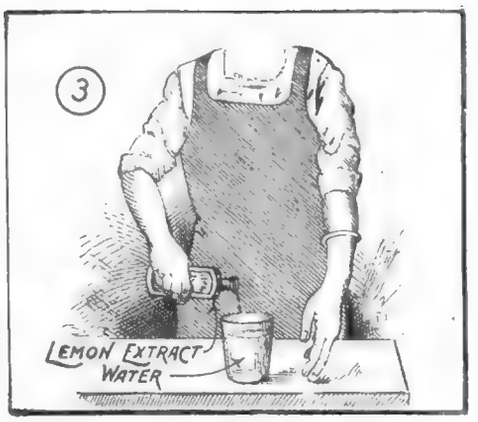
Everyday Chemistry

By Raymond B. Wailes.

Tobacco smoke that comes directly from flame is dark blue. That coming from the smoker's mouth is light gray because the tar is filtered out.

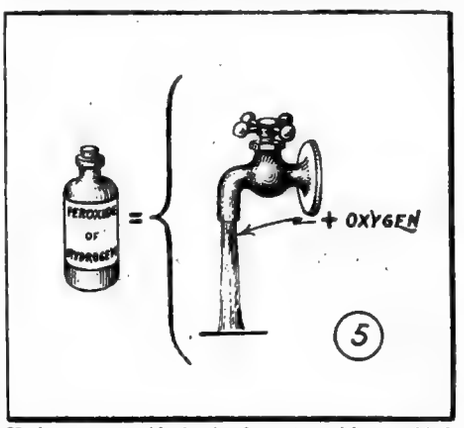


A blue gas flame turns yellow when washing powders are used around it because the sodium contained in them colors the flame.

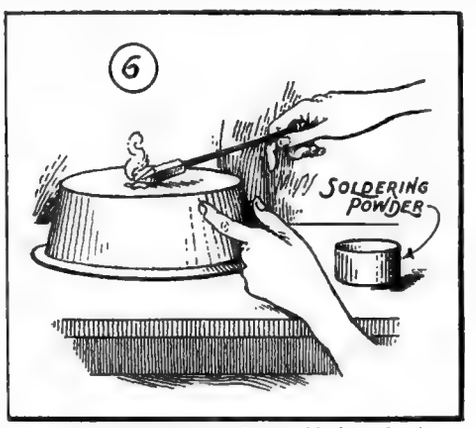


To test real and artificial lemon extract pour a little into a glass of water. If it is real a white cloud of lemon oil will appear.

To test butter for oleomargarine boil samples of both. The butter will boil slowly while the artificial product will sputter and splash vigorously.

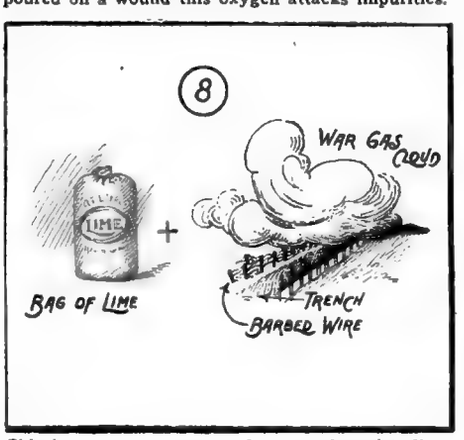


Hydrogen peroxide is simply water with an added molecule of nascent oxygen held in it. When poured on a wound this oxygen attacks impurities.



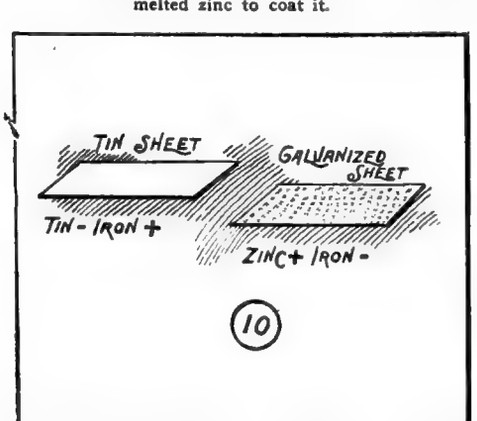
The difficulty encountered in soldering aluminum is caused by the swiftness with which it oxidizes as fast as the tinsmith scrapes it.

Galvanized pails are sheet iron coated with zinc. The whole finished pail is dipped into a bath of melted zinc to coat it.

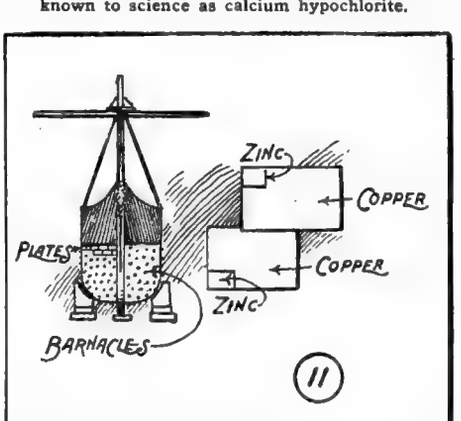


Chlorine, a war gas, and exposed moist lime join and form the every-day bleaching powder known to science as calcium hypochlorite.

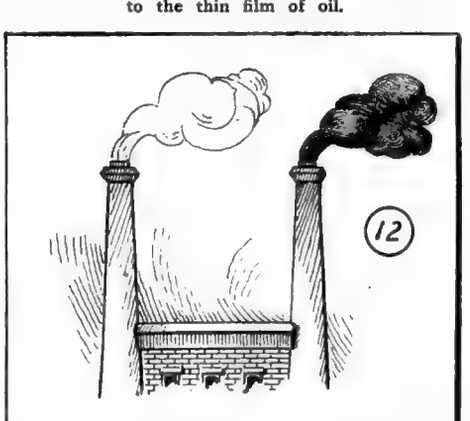
The changes of color caused by pouring oil on water is caused by the interference of light due to the thin film of oil.



So-called tin sheet is iron coated with a thin layer of tin. The tin protects the iron as would paint. Galvanized iron is iron coated with zinc.



To keep the copper on ship bottoms clean bits of zinc were nailed on the surface. The method failed as clean copper did not keep barnacles off.



Black smoke from a chimney indicates incomplete combustion. No smoke, on the other hand, may indicate far too much air and a greater loss.

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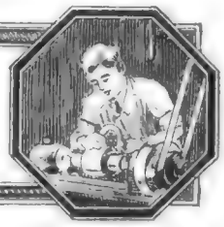
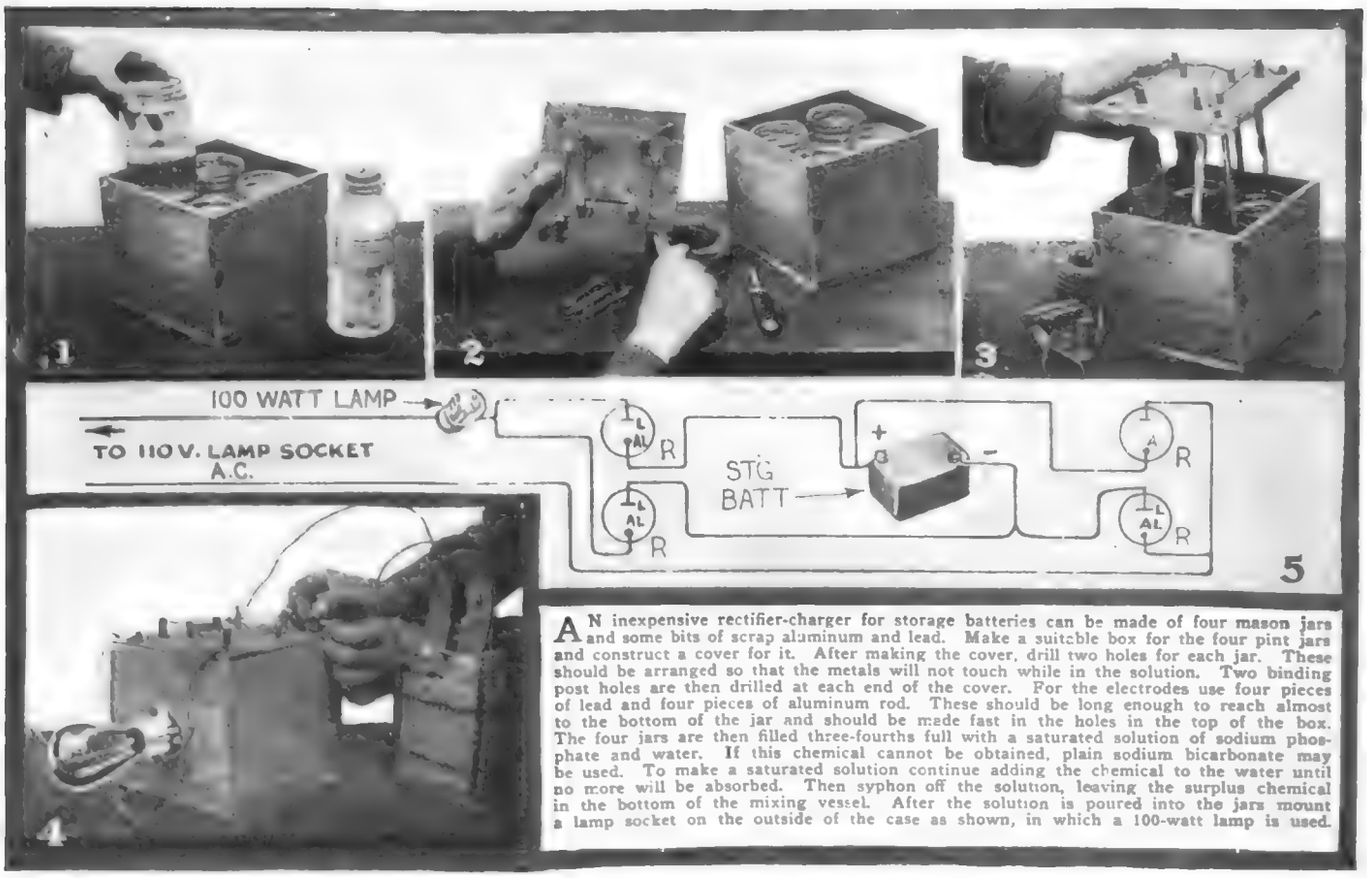
THE CONSTRUCTOR



Simple Battery Charger for A. C. Use

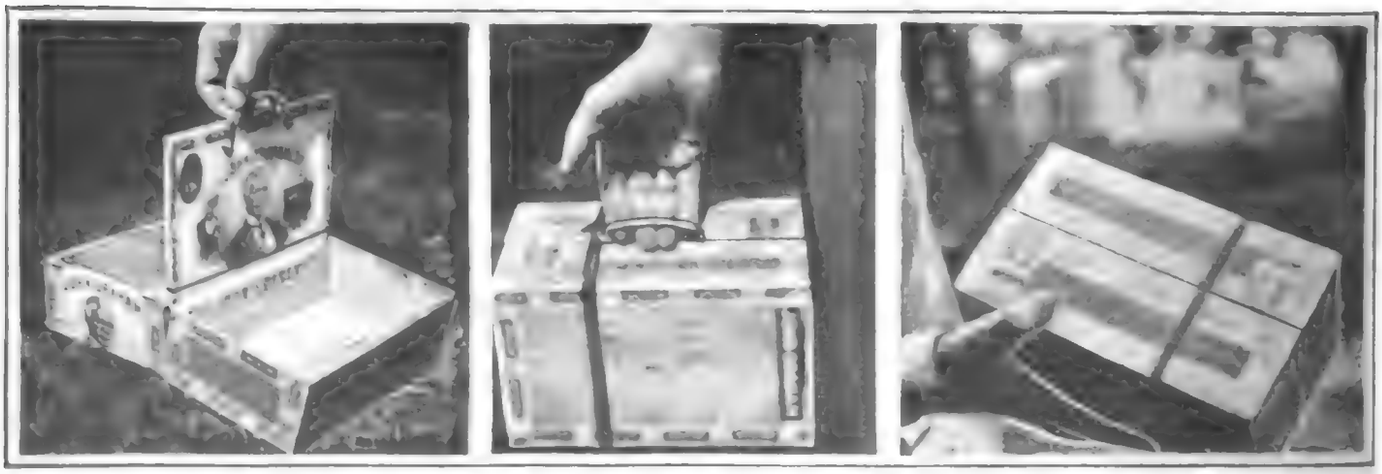
Complete electrolytic unit drawing one ampere

BY DR. ERNEST BADE



AN inexpensive rectifier-charger for storage batteries can be made of four mason jars and some bits of scrap aluminum and lead. Make a suitable box for the four pint jars and construct a cover for it. After making the cover, drill two holes for each jar. These should be arranged so that the metals will not touch while in the solution. Two binding post holes are then drilled at each end of the cover. For the electrodes use four pieces of lead and four pieces of aluminum rod. These should be long enough to reach almost to the bottom of the jar and should be made fast in the holes in the top of the box. The four jars are then filled three-fourths full with a saturated solution of sodium phosphate and water. If this chemical cannot be obtained, plain sodium bicarbonate may be used. To make a saturated solution continue adding the chemical to the water until no more will be absorbed. Then syphon off the solution, leaving the surplus chemical in the bottom of the mixing vessel. After the solution is poured into the jars mount a lamp socket on the outside of the case as shown, in which a 100-watt lamp is used.

KIT BOX MADE OF TWO CIGAR BOXES



A very handy tool box or lunch kit can be made with two empty cigar boxes, a bit of [illegible] and a couple of heavy rubber bands. The boxes are laid [illegible] raised next to each other as shown in the first picture. A rubber band is passed around the backs holding them [illegible]re is then bent in the form of a handle and made fast to the top of the lids by passing it through holes drilled in them. Notches are then cut in the edges of the boxes so they will close tightly over the handle. The second rubber band is then passed around the boxes in the closed position and the kit is complete.

—DALE R. VAN HORN.

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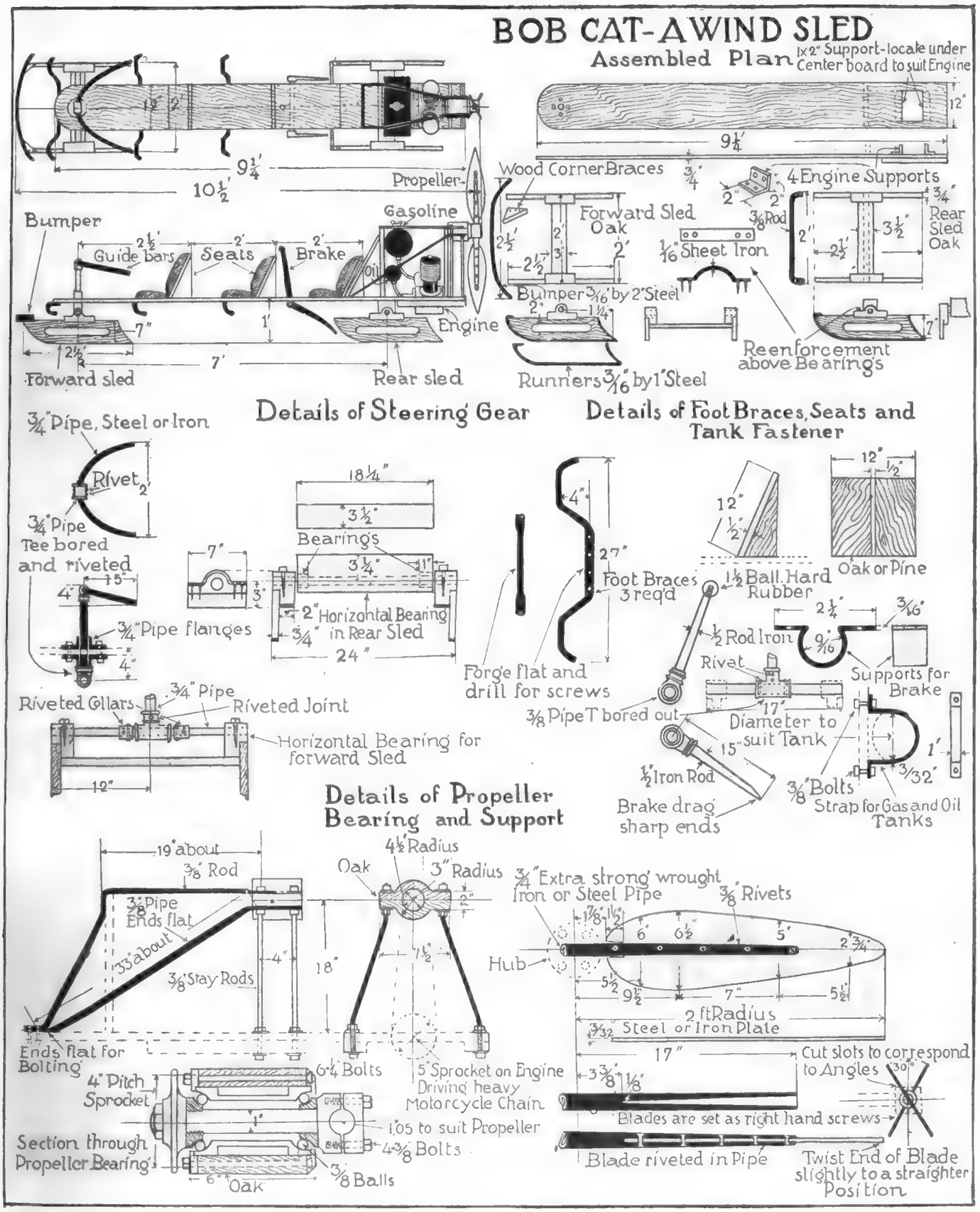
"Bobcat"--An Air-Propeller Sled

Capable of Fifty Miles Per Hour On Ice

By G. A. LUERS.



Equipped with a twin cylinder engine of the motorcycle type developing between seven and ten horsepower, the wind sled whose structural details are shown above, will work over pack snow and moderate hills, fully loaded. On ice it will develop upwards of fifty miles per hour. The method of constructing the body is shown in the plans. The cost is very moderate since the engine can be procured at from ten to thirty dollars. It need not be in the best of condition. A motorcycle sprocket shaft and bearings supply the propeller journals. The propeller is made of sheet steel and is firmly riveted into the steel tubing which carries it. The weight of the completed sled is just slightly over 200 pounds if the details given are followed.

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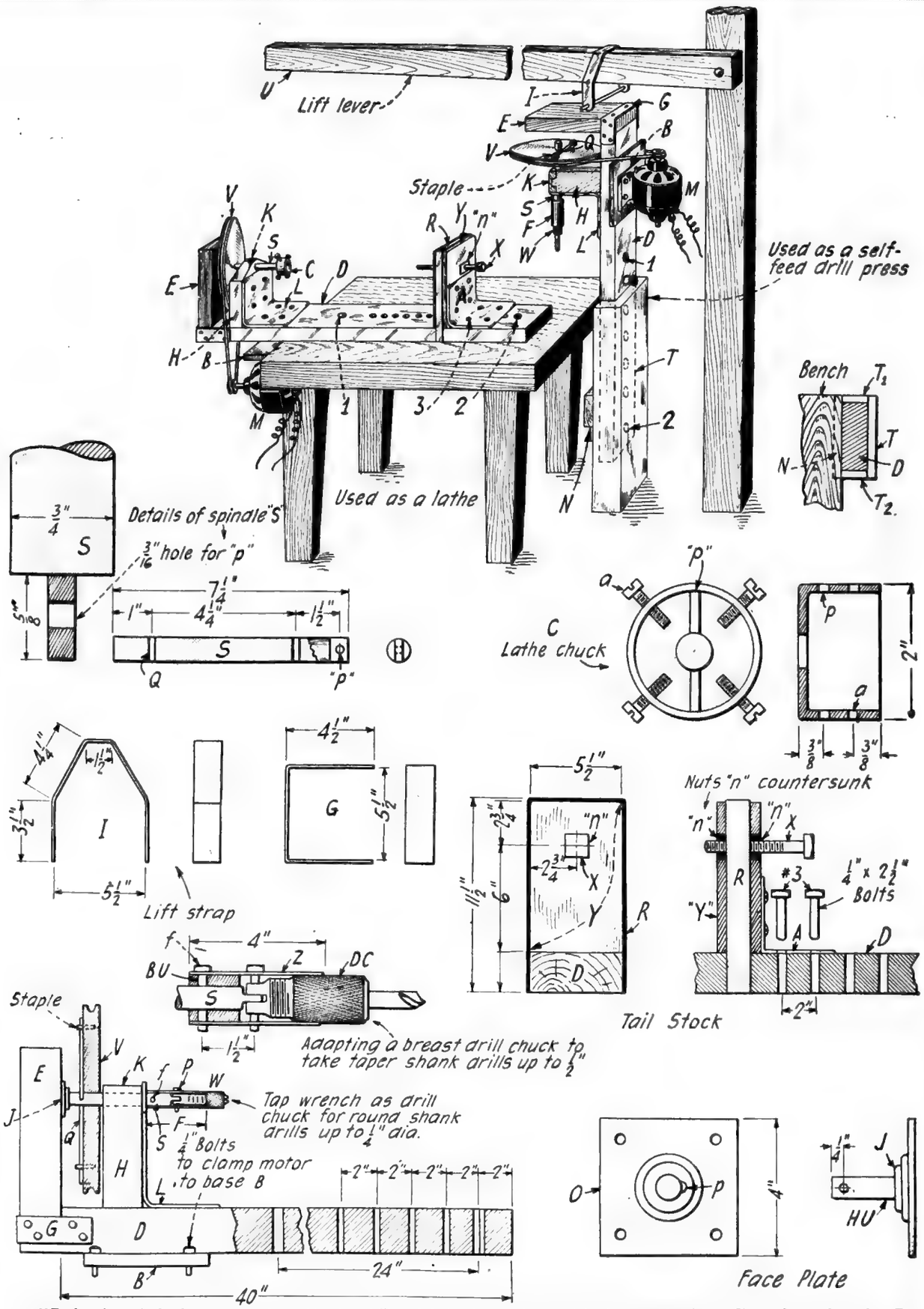
Combination Drill and Lathe


Lift lever
Staple
Used as a self-feed drill press
Used as a lathe
Bench
Details of spindle "S"
3/16" hole for "p"
Lathe chuck
Nuts "n" countersunk
Lift strap
Tail Stock
Adapting a breast drill chuck to take taper shank drills up to 1/2"
Tap wrench as drill chuck for round shank drills up to 1/4" dia.
1/4" Bolts to clamp motor to base B
Face Plate
40"
24"

THE cheaply and simply constructed combination drill and lathe shown above might be considered too flimsy for real work. The author has, however, used one similar to it for six months and it has given good service. Most of the structural details are shown. The chuck is taken from a discarded breast drill. The slot in the chuck which takes the shaft tongue is made at right angles to holes, which take the pin holding the chuck to the staff. The motor used is of the one-quarter horse-power A.C. variety. The ratio of the pulleys is one to eight. The shank of the face-plate is slotted to take the tongue of the shaft and it is used with the sleeve the same as the drill chuck attachment. —F. J. Marsa.

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How to Make a Storage "A" Battery

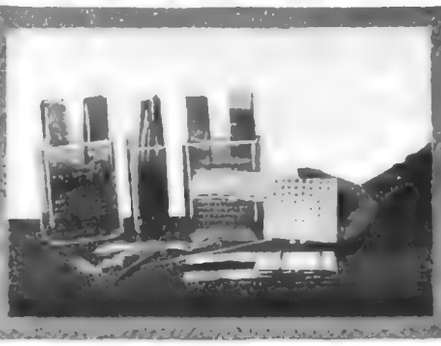
BY DR. ERNEST BADE

In making the storage "A" battery shown here the first step is the manufacture of a puncher. Attach a heavy nail to a stick fulcrum as shown and drill a hole in the baseboard for a guide for the nail. Another board nailed to this serves as a guide for the plates.

The next step is marking the size of plates. They are made of lead about 5-64 inch (2 mm.) thick. If the plate is to be four by six inches cut it eight by twelve leaving ample material for the lug. The finished plate is double the thickness of the original lead.

The third step is punching the blank plate. Place the blank on the bench and mark it in half-inch squares. Put a hole at the corner of each square with the punch. Of course, only the body of the plate is thus punched, the lugs being left solid as shown above.

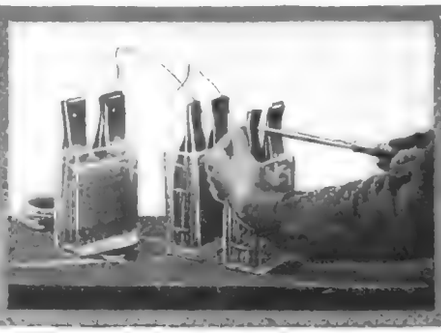
Fourth—Bend the punched plate in the middle of the lug as shown in the picture above, being careful to see that one edge laps over the other about three-sixteenths of an inch. This lap is to be left for clinching the completed plates in one of the later steps in the process.



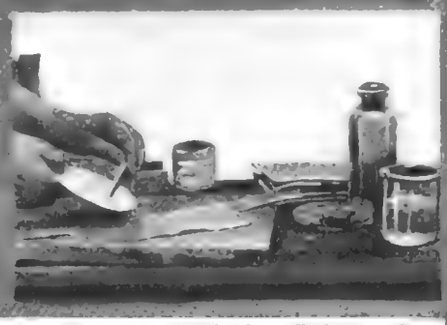
The bent plates are then placed in a bath of half nitric acid and half water and allowed to stand for twenty-four hours. In making the acid solution be careful to add the acid to the water by pouring it into the water very slowly, while stirring the mixture with a glass rod.

Wash the plates thoroughly after removing them from the acid. Place two glass rods on top of one and then lay another on the rods with the lug on the opposite side. Continue this until there is a total of five plates. Then bind them with rubber bands as shown above.

Place these units in glass battery jars and cover them with a solution of one part concentrated sulphuric acid and nine parts water, being careful to add the acid to the water while stirring. The solution will heat.



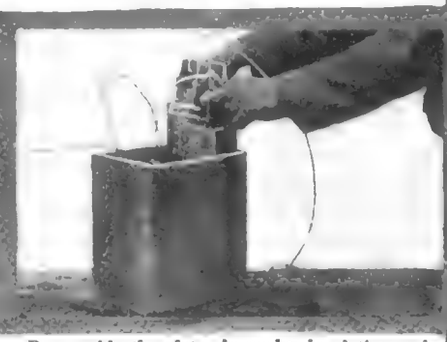
Drill the lugs for copper or brass bolts as shown in the above illustration. The three plates of the unit are the negative, the others positive. Connect in series and the negative lead to the positive of the charger.



Leave the plates in circuit until the negative plates turn a dark brown. Then short-circuit the battery with a piece of No. 14 iron wire about thirty feet long until the negative plates resume their normal color.

Then charge again connecing the positive of the battery to the positive of the charger until the plates bubble at the same rate. Then remove and dry them. Cover the negative plates with a paste of litharge and the sulphuric acid solution. Moisten plates with solution first.

Cover the positive plates with a paste made of the solution and red lead in the same way. Then refold the plates, clinching the edges as shown and place them under a heavy weight for twenty-four hours. Remove all excess paste with a cloth moistened with the acid.



Reassemble the plates in packs, insulating and binding as before, and return them to the acid solution. Connect them in series and charge by connecting the positive lead to the positive pole of the charger and negative to negative. Each cell will develop two

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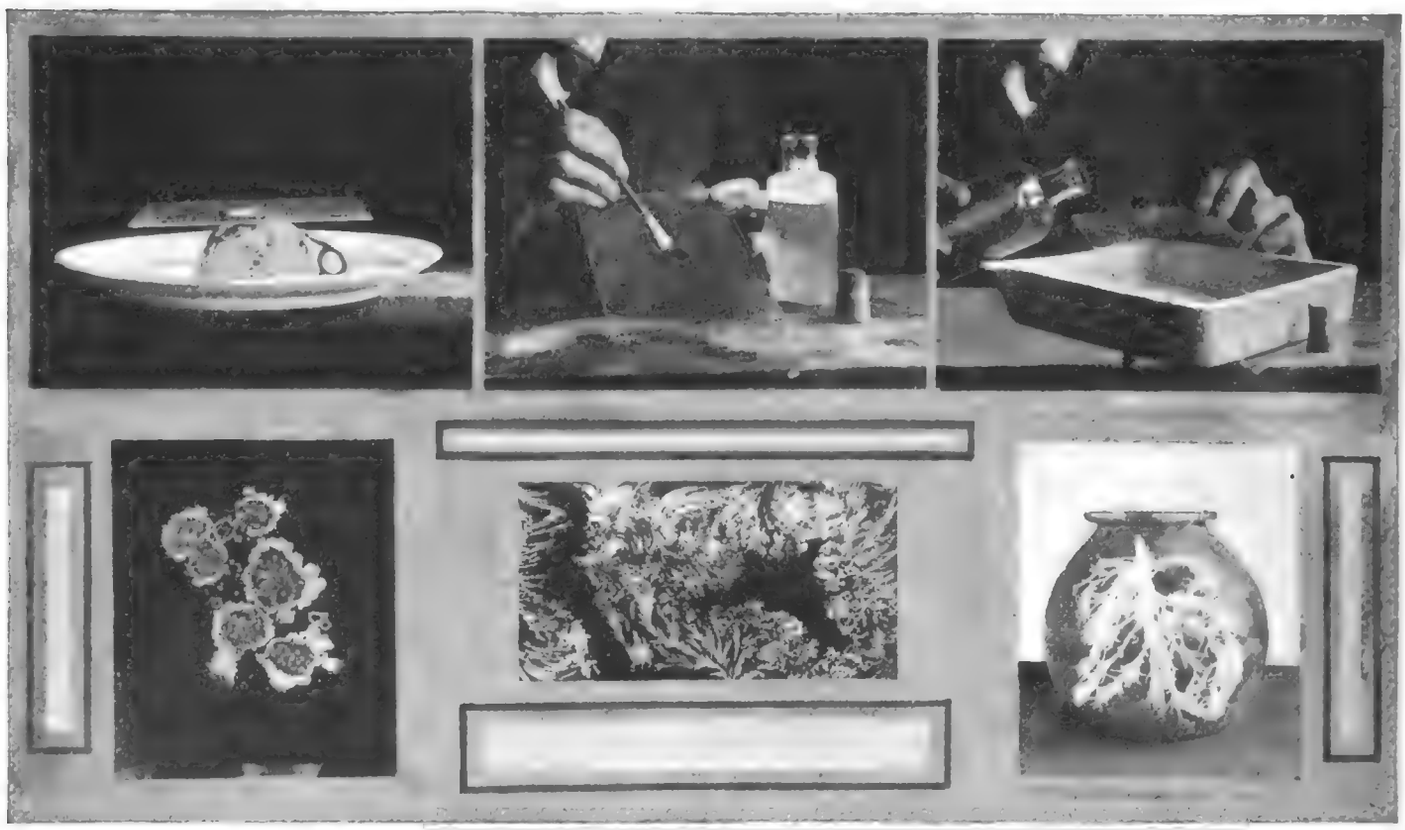
WRINKLES
RECIPES & FORMULAS

Capturing Frost Crystal Forms

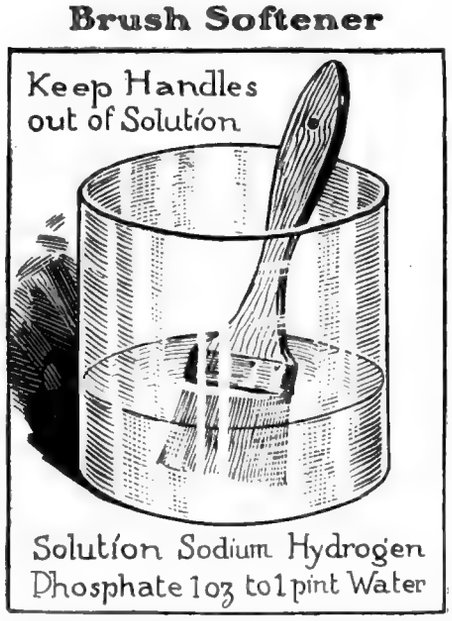
Simple method of fixing frost designs on glass

THIS MONTH'S $5.00 PRIZE TO S. LEONARD BASTIN



A novel method of obtaining decoration designs is that of fixing the flower-like figures made by frost. A simple method of placing such designs on glass is shown above. The vessel to be decorated is covered with a thin coat of a solution made of two per cent of gelatin added to distilled water. This is brushed evenly over the surface and the piece to be coated is left out in freezing weather for the formation of the crystals. After their formation, the work is rinsed in methylated spirits which removes all but the figures. The whole is then covered with a coat of clear varnish. If the designs are desired in colors it is only necessary to add a dye of the preferred tint to the gelatin solution.

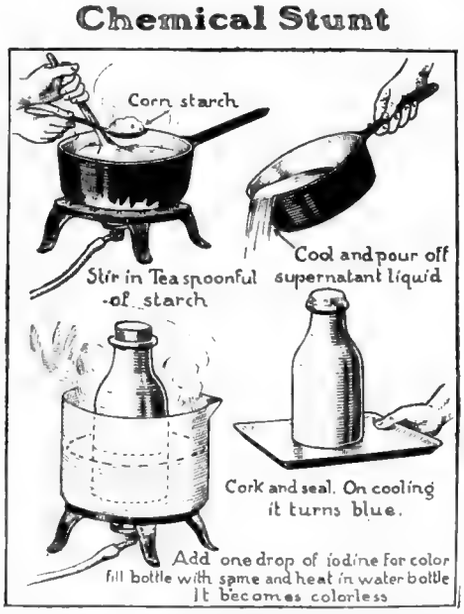
Brush Softener



To remove dried paint in brush bristles, soak them three days in a solution of Sodium Hydrogen Phosphate, being careful that the handle is not in the solution. Then wash well with soapsuds and water. Rinse in clear water.

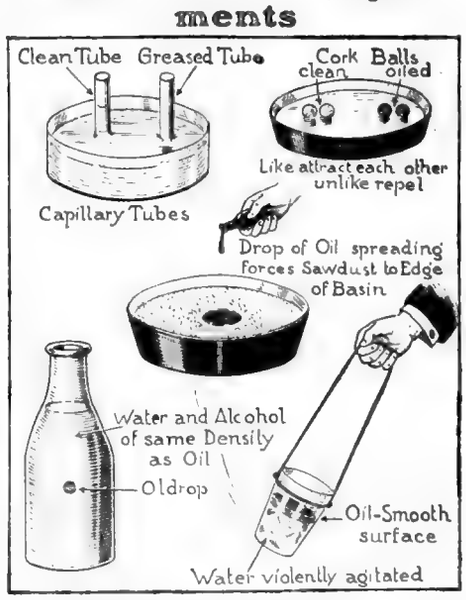
—ALDEN JOHNSON

Chemical Stunt


Corn starch
Stir in Tea spoonful of starch
Cool and pour off supernatant liquid
Cork and seal. On cooling it turns blue.
Add one drop of iodine for color fill bottle with same and heat in water bottle It becomes colorless

To a solution of 1 teaspoon of cornstarch in a pint of boiling water add one drop of iodine tincture. Bottle the blue liquid and heat the bottle in water until the solution clears. Cork and seal with wax. When the bottle is brought to room temperature, the color returns.—CHAS. D. TENNEY

Water and Oil Experiments



No capillary action in greased tube. Oiled and clean balls repel. Sawdust on water repelled by oil. Oil drop will stay suspended in solution as shown. Oil unaffected by centrifugal force.

—CHAS. D. TENNEY.

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HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.

The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

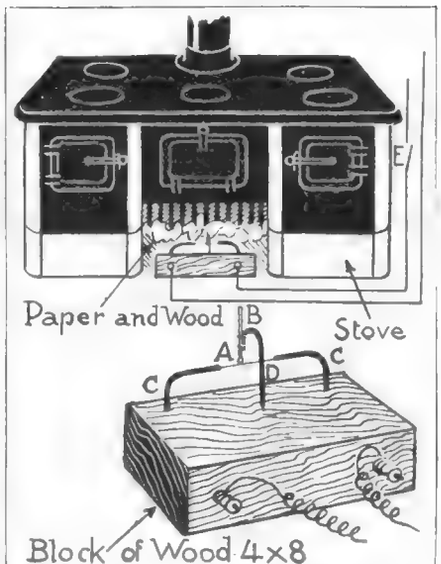
Drain Repair

FIRST PRIZE $15

Remove the top and bottom of condensed milk cans and use to repair old drain pipes. They fit the 3-in. pipe. —J. H. Shalek.

Stove Lighter

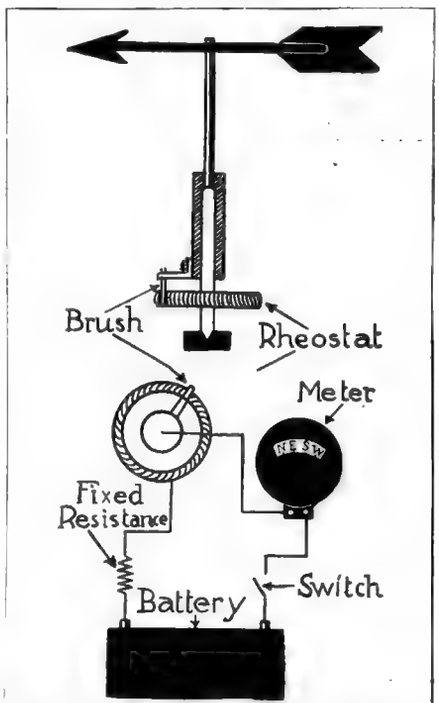
SECOND PRIZE $10



By placing two heavy wire terminals in a block of wood and connecting them with a fine wire, then inserting a third wire for a match support as shown in the above sketch, an admirable automatic fire lighter is made. A fine wire which will heat red with the passage of a small current is placed across the two heavy terminals and when the circuit is closed the match and fire are lighted. —Preston Goldberg.

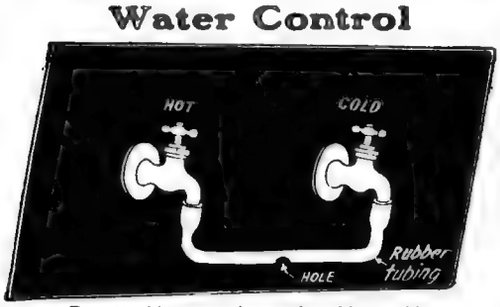
Wind Indicator

THIRD PRIZE $5



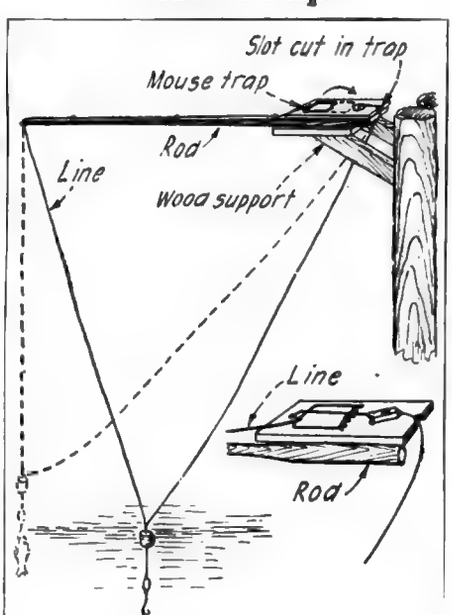
By attaching a weather vane to a rheostat (above) and placing a galvanometer in the circuit, graduated N.E.S.W. a distant wind indicator is made. —John Smith.

Water Control



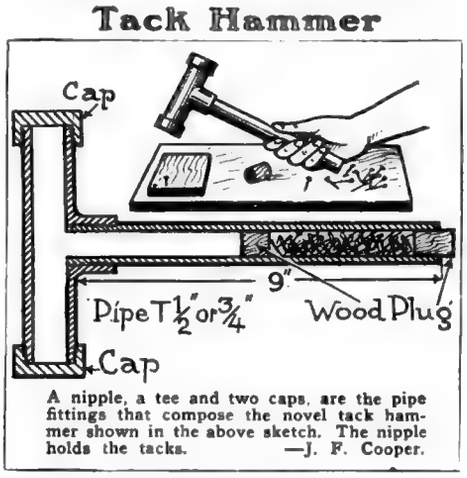
By attaching a piece of rubber tubing, notched in the center, to the hot and cold water taps the temperature of the water is controlled. —Geo. Frederick.

Fish Trap



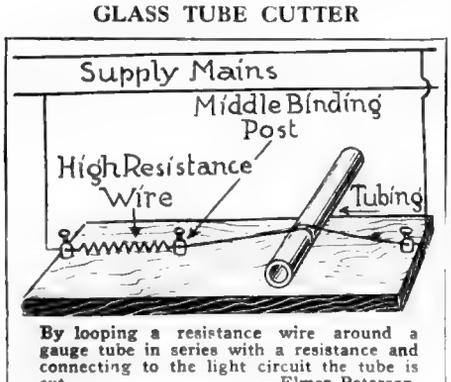
The fisherman may toast his toes by the camp fire while this device catches his breakfast mess of fish. It is just a rat trap connected into the double fish line in the manner shown. At a bite the trap springs pulling the fish out of the water. The line runs from the bank out over the stream through staples on a pole. The trap is fixed to a post as shown. —John Cooper.

Tack Hammer



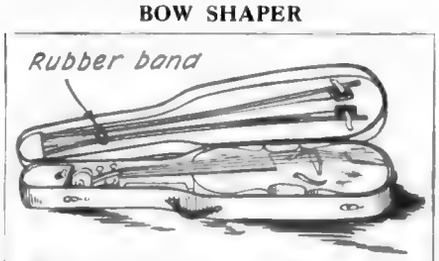
A nipple, a tee and two caps, are the pipe fittings that compose the novel tack hammer shown in the above sketch. The nipple holds the tacks. —J. F. Cooper.

GLASS TUBE CUTTER



By looping a resistance wire around a gauge tube in series with a resistance and connecting to the light circuit the tube is cut. —Elmer Peterson

BOW SHAPER



Snap a rubber band around violin bows in their case as shown above if you would keep them in their best shape. —Antonio Y. Matia

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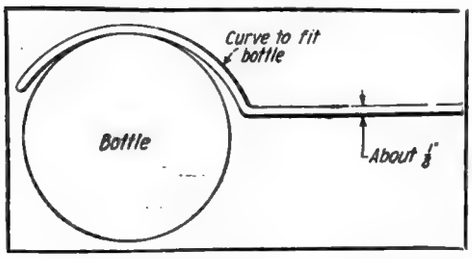
Bottle Cutter

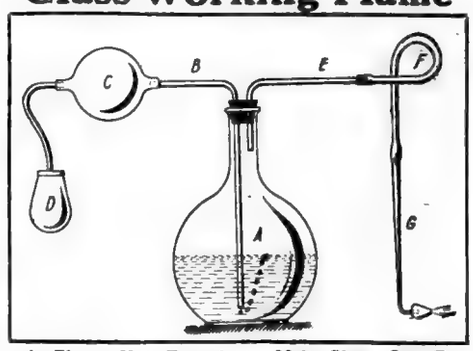


This Tool for Cutting Bottles is Made of Iron or Copper Wire Bent So It Is in Contact with About an Inch of the Bottle's Surface at a Time. Mark the Point Where the Bottle is to be Cut with a File Scratch. Then Place the Wire, Heated to Redness, on the Crack. In About Thirty Seconds it Will Crack. Continue Around the Bottle Until Top Comes Off.—Harry Lubcke.

Faucet Protector

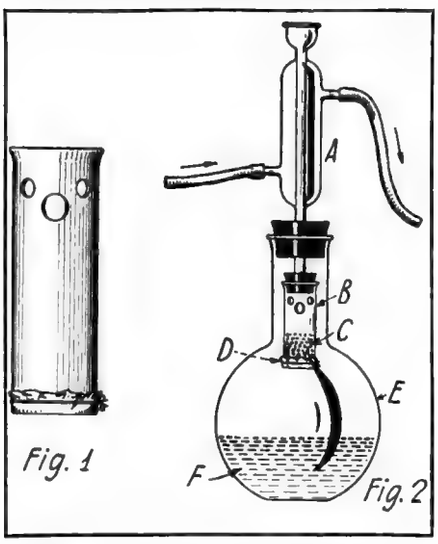
The Above Shown Faucet Protector, Made from Half a Rubber Ball, Will Save Fifty Times Its Cost in Broken Crockery. It Does Not Interfere With the Water.—S. L. Bastin.

Glass Working Flame



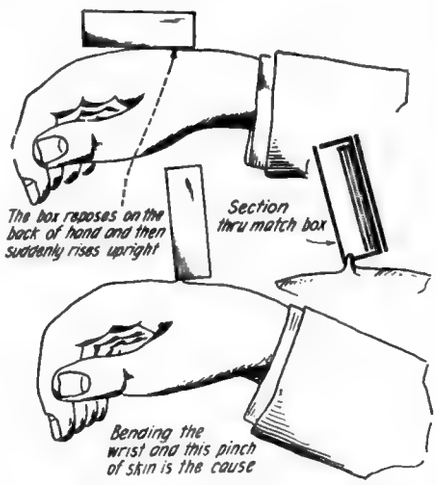
A Flame Hot Enough to Melt Glass Can Be Obtained from This Flask Filled with Alcohol, Through Which Air is Circulated from Bulb (D). Through Toy Balloon (C) Into Blow Pipe (G).—Arthur S. Clark.

Fat-Oil Extractor



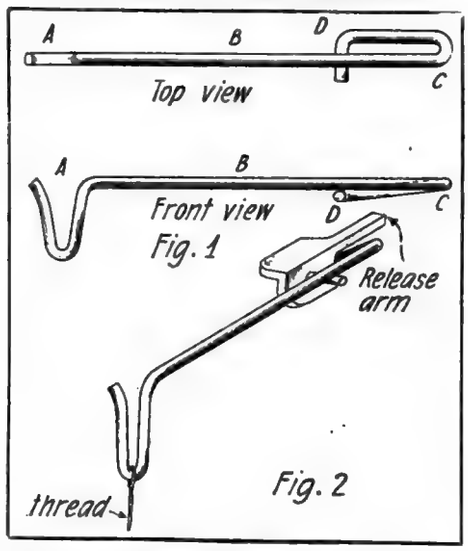
By Halfing a Test Tube and Cutting Holes at Its Top and Attaching It to Liebig Condenser as Shown in Sketch, Fat-Oil from Milk, Etc., Can Be Extracted. (C) is Dehydrated Milk. (F) is Either Ether or Carbon Disulphide, Kept Almost Boiling, Which Dissolves Oil.—S. B. Seeley.

Match Box Trick


The box reposes on the back of hand and then suddenly rises upright
Section thru match box
Bending the wrist and this pinch of skin is the cause

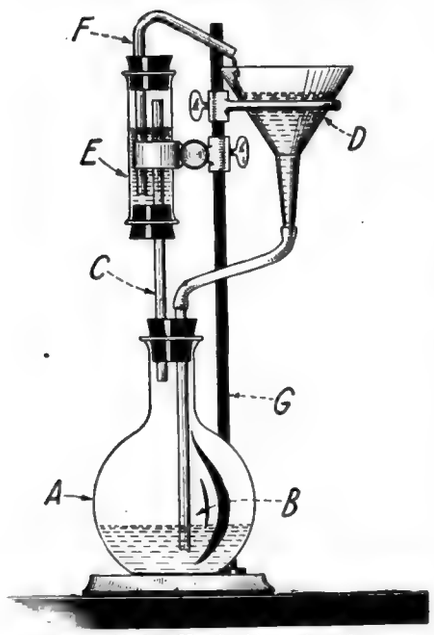
This Trick is Easily Performed by Pinching a Small Bit of Skin Between the Box and the Container of a Safety Match Box. If the Hand Is Now Bent, the Box Will Immediately Fly Upright.—G. A. Luers.

Shutter Attachment



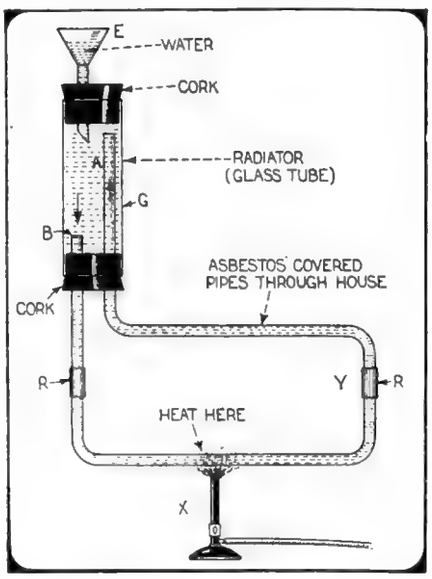
This Camera Shutter Attachment for Self-Portraiture is a Bit of Stiff Wire Bent as Shown. To Attach, Spring Open Bend, Place Under Release Arm and Over Pin Shown in Fig. 2.—F. M. Weston, Jr.

Hero's Fountain



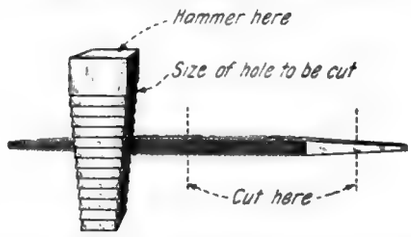
...e Model Hero's Fountain Shown in ... (E) and (A) Nearly Full of Water. ...kly Fill (D), Thus Forcing Water in ... out at (F).—C. D. Tenney.

Heater Model



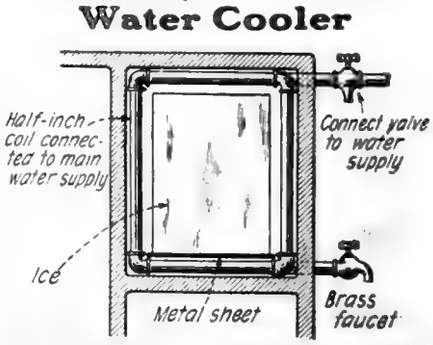
This Model of the Hot Water Heating System Can Be Constructed from Apparatus in Any Laboratory. Be Certain to Equip with Funnel Which Acts as the Expansion Tank. If a Drop of Ink is Put in the Water the Circulation Can Be Seen.

Square Hole Punch



To Make Square Hole Punch Shown, Draw Temper in Square File, Cut Notches with Fine Abrasive and Retemper.—D. R. Van Horn

Water Cooler



This Water Cooler is of Half Inch Pipe Coiled in Bottom or Side of Ice Chest. No Filling is Necessary but the Coil Should Be Flushed at Least Once a Day to Be Sanitary.—M. Benjamin.

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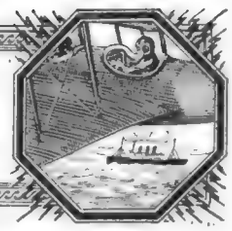
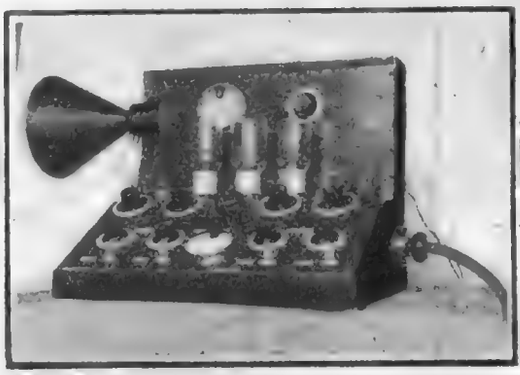
RADIO



Loud Talker Without Microphone

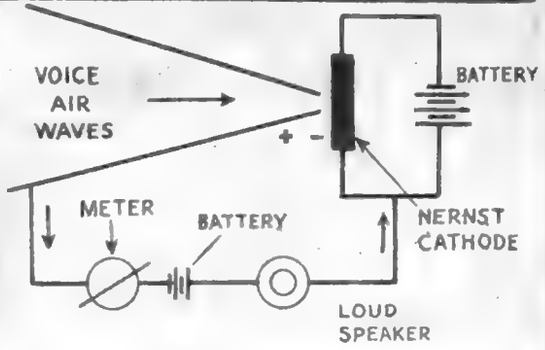
Absence of Iron Diaphragms Gives Perfect Reproduction

BY DR. ALFRED GRADENWITZ



Above: The transmitting apparatus connected with broadcasting radio apparatus. To the left below is shown the reproducing units installed in a hall for a concert. At the left is shown an opera singer standing before the transmitter in operation.

Below: Close-up of unit of the reproducing apparatus.



German inventors have evolved the recording and loud-speaking device shown above which gives perfect reproduction. In the sketch at the right is shown the diagram of the recording apparatus which operates by the effect of the voice on a stream of ions flowing from the incandescent rod of a Nernst lamp. The reproducer depends on the varying attraction of electrostatic charges a metal plate and a mica diaphragm.

$12,000 or More in Gold

Beginning with the January issue, SCIENCE AND INVENTION will pay $1,000.00 or more each month of the year in prizes. Every article published in the regular news section will receive one of them.

(The departments have awards of their own which they will continue to give.)

Ideas are what the editors want. They must be told simply—so your mother or sister can understand them—in pictures and sketches. Be sure they are NEW and have something to do with science or invention. The editors want pictures and sketches—must have them—but ideas are wanted most of all.—And they will be handsomely paid for. The rules of the contest will be found on page 534 of the October issue. If you haven't a copy, one will be mailed you free on receipt of your name and address. It will give full details of the rules and hints on submitting articles. The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of December for the February number; the 15th of January for the March number, etc.

88 monthly prizes will be given as follows:

FIRST PRIZE			$100.00
2	PRIZES	of	$50.00 each
10	"	"	25.00 "
5	"	"	20.00 "
10	"	"	15.00 "
20	"	"	10.00 "
10	"	"	5.00 "
20	"	"	2.00 "
10	"	"	1.00 "

$12,000 or More in Gold

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketchs of the hook ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We want articles on the latest single tube receptors which require a minimum current from the filament battery.—Editor.

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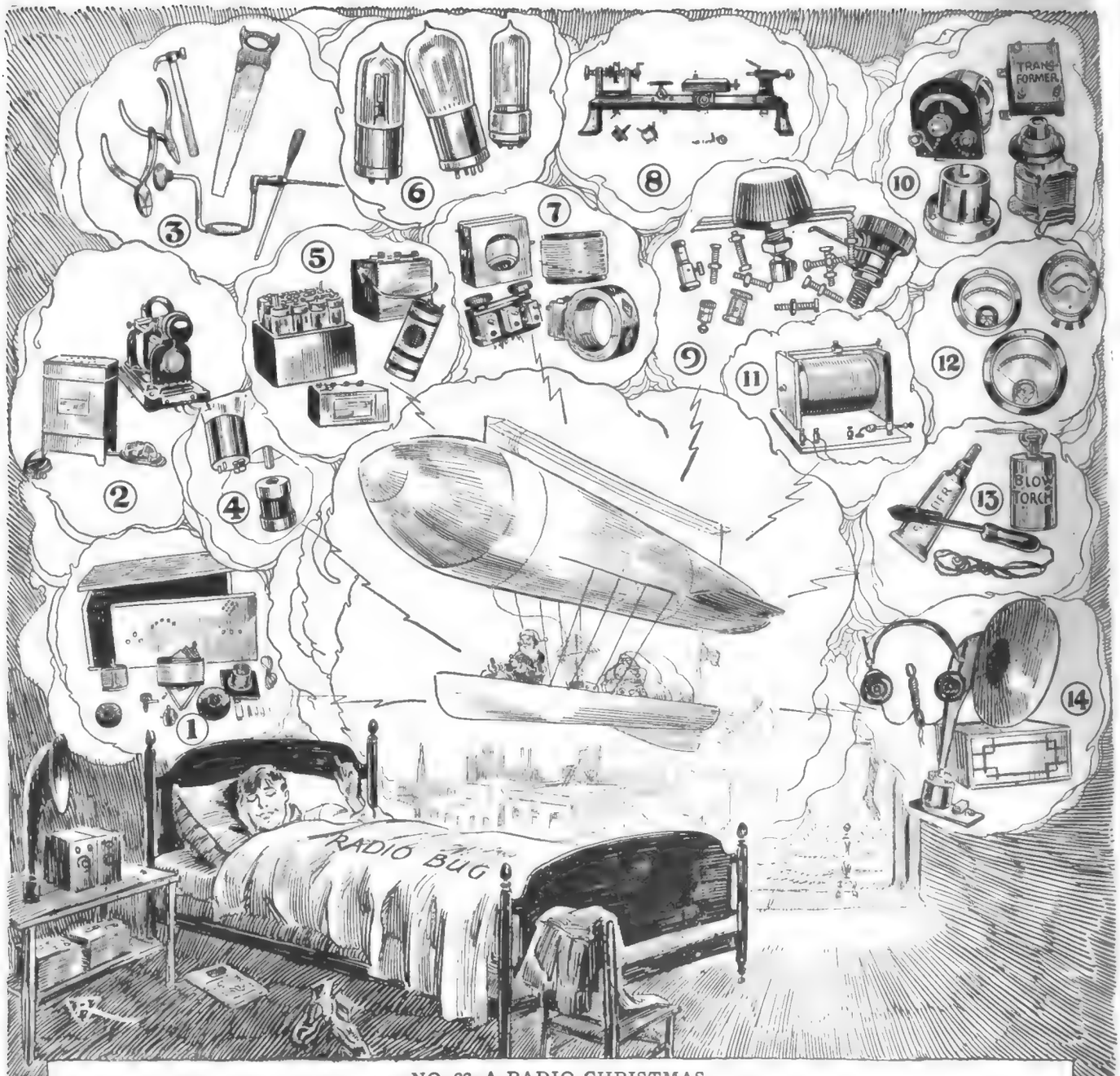
Radio for the Beginner

Suggestions for useful gifts to "radio bugs"

BY ARMSTRONG PERRY.



NO. 22, A RADIO CHRISTMAS

THE S. P. U. G. (Society for the Prevention of Useless Giving), is with us again. This time it is dealing with the matter of radio, something which is in the minds of everyone at the present time. Above, in the Radio Bug's Dream, will be seen a few suggestions for gifts.

His apparatus on hand at present must be taken into consideration so that duplicates will not be given, and in order that the recipient shall find himself in possession of material which will be of use to him in expanding his present set. If the radio enthusiast has only a crystal set, do not present him with a loud speaker (Fig. 14), or some other useless instrument. Rather, present him with a vacuum tube(Fig. 6), so that his range can be extended and in this way bring joy and happiness to his home.

To the man or boy, or for that matter, the woman, who likes to build radio sets, there are many tools (Fig. 3), which will be greatly appreciated. A lathe (Fig. 8) is something desirable but usually unattainable to the average amateur. Batteries and chargers (Figs. 5 and 2) can always be used, the latter, however, only when A.C. [illegible]. Parts (Figs. 1, 7, 9, 10 and 12) can be used for additions to present sets. The beginner would appreciate a crystal set (Fig. 11). Soldering [illegible] (Fig. 13) are useful. A simple but welcome present [illegible] vacuum tube fuses (Fig. 4). An extra pair [illegible] (Fig. 14) will always find favor. To our mind radio apparatus makes the best present that anyone can give to those interested in the most fascinating of all [illegible].

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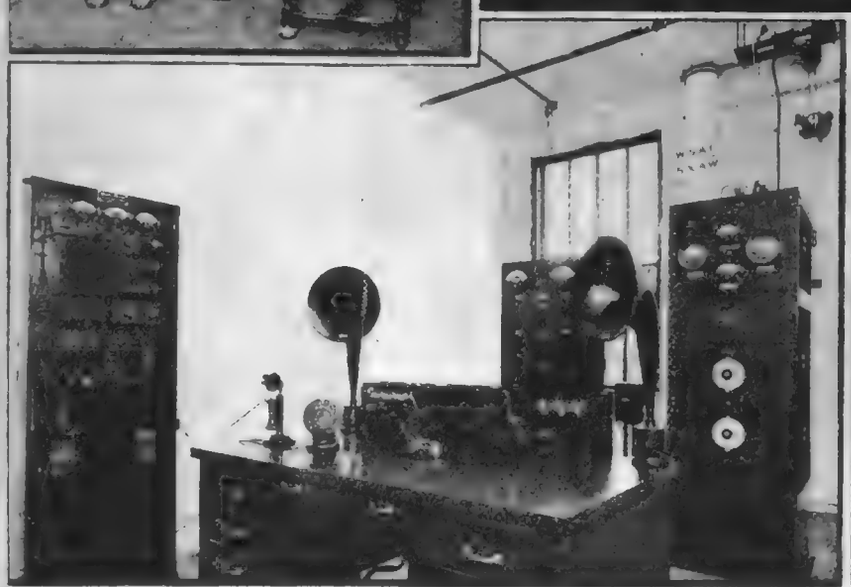
BROADCAST STATIONS



The Upper Left Hand Photograph Shows Mr. P. A. Green, Radio Engineer of Station WSAI of the United States Playing Card Company of Cincinnati, Ohio. Lower Left: The Radiophone Broadcasting Apparatus of WSAI Can Be Seen in the Background, with the Voice Amplifier on the Extreme Left. On the Desk is Located the Monitoring Apparatus for Checking Up on the Programs. Announcements May Also Be Made from This Desk. Above, at Right: The Antenna System of WSAI Supported on Two Steel Towers 167 Feet Above the Street Level. The Active Antenna Length is 65 Feet with a Lead-in of 137 Feet.

On the Right May Be Seen Miss Vaughn de Leath, Managing Director of Station WDT of the Ship Owners' Radio Service and Premier Grand Piano Corporation, New York City. Miss de Leath Makes Claim to the Title of the "Original Radio Girl," on the Grounds that She Was the First Young Lady to Have Ever Broadcasted from a Radiophone Station. This Took Place in 1920, and the Transmitting Was Done by Dr. Simon, from the World Tower Building in New York City.

Miss de Leath is Also known to Every Song Writer and Singer, Having Done Some of This Work Herself. She Has a Remarkable Contralto Voice and Very Often Entertains the Radio Fans from Station WDT.

This Latter Station Has Established Quite a Record of Late, Having Been Heard in Every State East of the Mississippi, and Several West of That River. The Transmitting Apparatus of WDT May Also Be Seen in the Photo at the Right.

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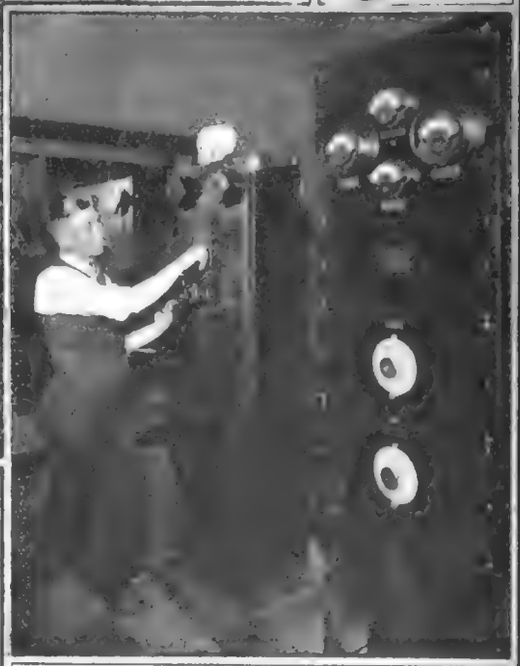
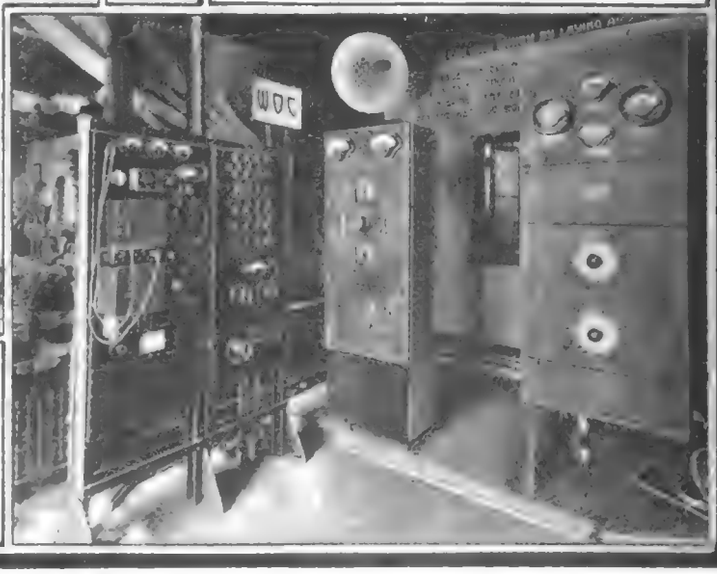
BROADCAST-STATIONS

The studio of the newly opened WOAW, broadcasting station of the Woodmen of the World, is shown in the photo directly above. Despite the unfavorable time the station began work—last April 2nd—reports have already been received by the operating staff that the station has been clearly heard over a great part of the United States. The most outstanding report so far received was a card signed by the operator aboard the S. S. White to the effect that he picked up the station clearly while his vessel was proceeding 1,700 miles south of San Diego, Cal. The insert in the center of the page shows a corner of the building on which the aerial is installed. The masts that carry the antenna reach more than 170 feet above the level of the street. The regular broadcast program is carried on from this station, including weather reports, lectures, and musical concerts.



Above is shown Engineer Stenback of Station WOAW at the transmitting instrument board of his station. Below is shown the instrument room of Station WOC, owned and operated by the Palmer School of Chiropractic, Davenport, Iowa. The two panels at the left are the controlling units of the public address system through which addresses given in the school are broadcast while they are being made. Through it, speakers in any part of the institution may make public a lecture at the same time they are giving it to a class. The power control board may be seen beneath the monitoring horn in the center. The transmitting apparatus proper is housed in the panel to the extreme right.

Above is shown the antenna system of WOC. The towers are placed atop one of the buildings of the school. Their total height is 130 feet above the street level. They are more than 300 feet above the level of the Mississippi River. On account of the severe winds that hit the city in the winter months special care had to be taken in the construction of the masts to make them proof against the gales. At night the towers are outlined by flood lights which make them visible for miles around the tri-cities. This station has a good distance record to its credit and has given great satisfaction in its operation. It was installed as a means of advertising the chiropractic system of healing.



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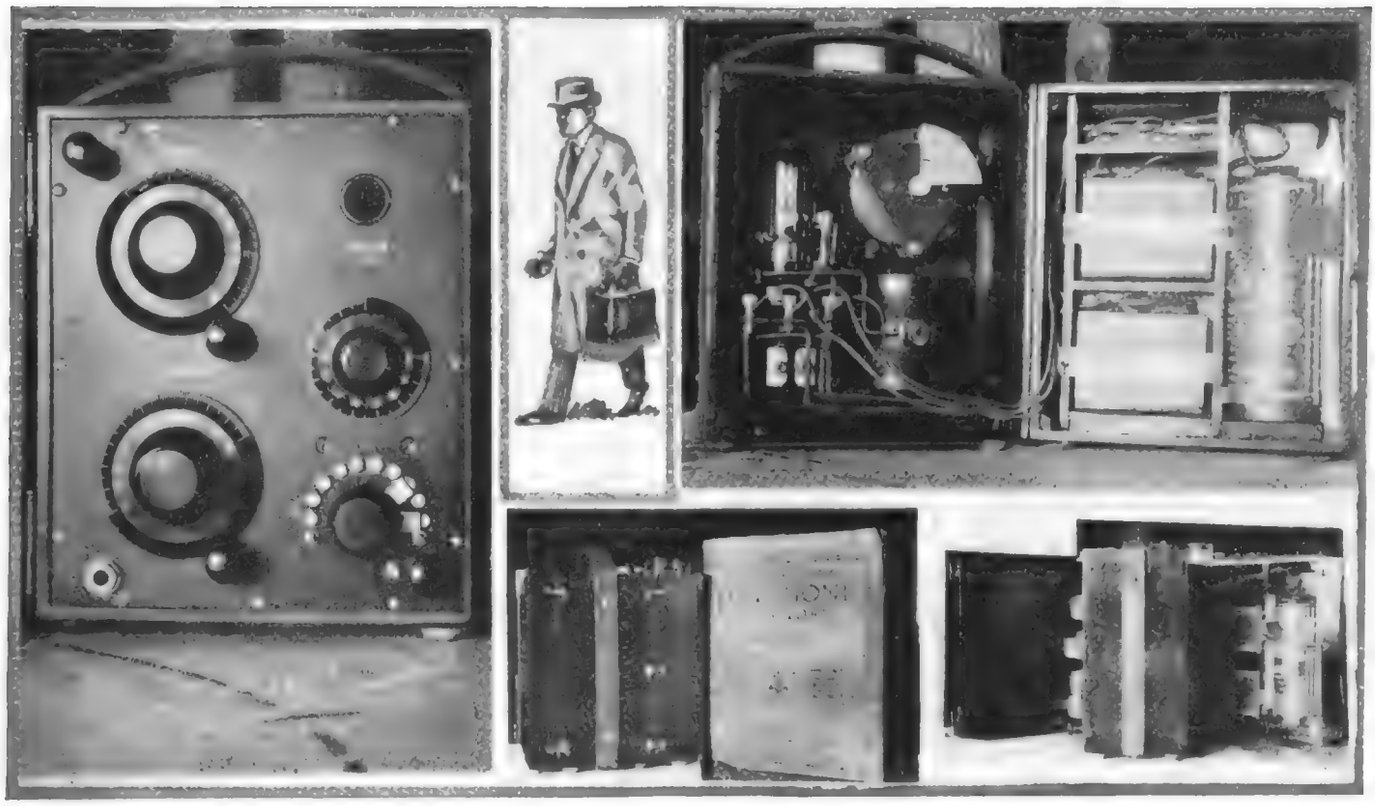
The Compact "Single Six" Circuit

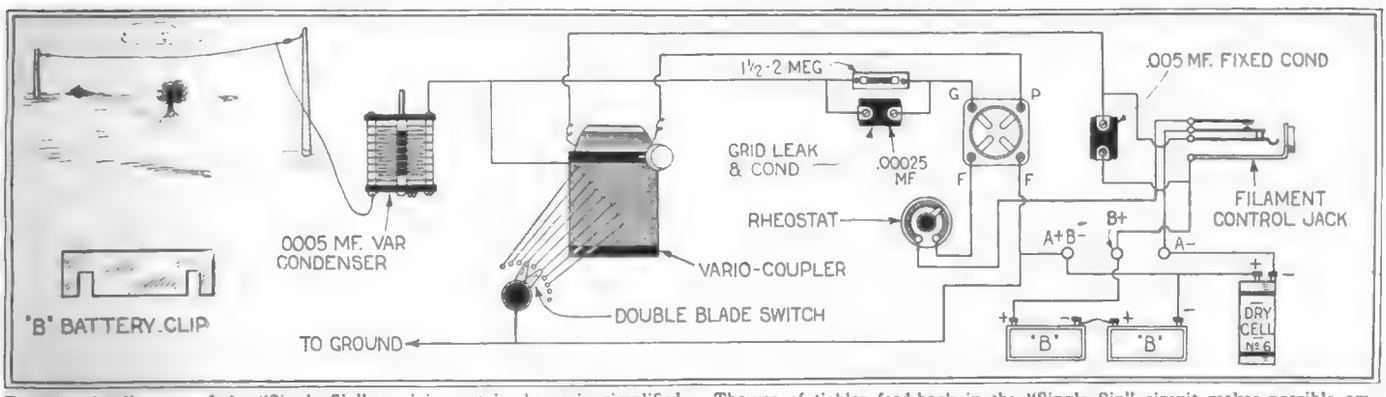
Operated With One No. Six Dry Cell Supplying the Filament Circuit

By H. E. HAYDEN



This set, called the "Single Six" receiver by the author, because the "A" battery is a single No. 6 dry cell, is illustrated in its completed form above at the left. In the lower center, the set is shown in comparison with a standard telephone directory, illustrating its compactness.

Upper right: An interior view of the set showing the compact wiring and placement of the "A" and "B" batteries.
Lower right: Illustrating the construction of the cabinet enclosing the entire "Single Six" receiving set and batteries.



The circuit diagram of the "Single Six" receiving set is shown in simplified form above. Note the filament control jack, by the use of which the filaments will be extinguished upon removing the phone plug from the jack. This set will give fair selectivity and excellent volume under all conditions.

The use of tickler feed-back in the "Single Six" circuit makes possible amplification by means of regeneration and the auto-transformer effect in the primary reduces losses. At the extreme left will be seen the form of the "B" battery clip used for connecting the "B" battery together.

RADIO VISION

AT LAST the instrument that will make sight at a distance possible has been invented. If you are an old reader of the ELECTRICAL EXPERIMENTER and SCIENCE AND INVENTION, you will remember all the different articles we had on the Telephot and various television schemes. But now an instrument has been invented which is fully described in the December issue of RADIO NEWS by Mr. H. Gernsback, Editor, who saw it in operation at Washington recently. Mr. Gernsback has actually seen a picture of his hand transmitted by radio while he was moving the hand to and fro.

Dr. Lee De Forest, inventor of the Audion, comes forward with his latest invention, "The Radio Chauffeur Call."
Last, but not least, John V. L. Hogan, I. R. E., famous radio expert, tells us all about the new super-sensitive vacuum tube, the "Sodion." This is an exclusive feature for RADIO NEWS.

List of principal articles to appear in RADIO NEWS for December:

The Clariphone, a New Static Eliminator
By S. R. Winters
The Radio Controlled Aeroplane,
By Maurice Percheron
Construction of Super-Heterodyne Receivers,
By F. de Willy and R. E. Lacault.
Simplifying the Radio Receiving Set,
By John Ashton Greig.
A New High Power Tube,
By Laurence S. Lees
Commercial Possibilities of Wired Radio for Central Stations,
By Bert T. Bonaventure
Canadian Station 9BP Reaches Arctic,
By Jack Barnsley.
Notes on the Autoplex Circuit,
By M. L. Muhleman
Observations at the Receiving End of the Radiophone,
By W. A. Knight.

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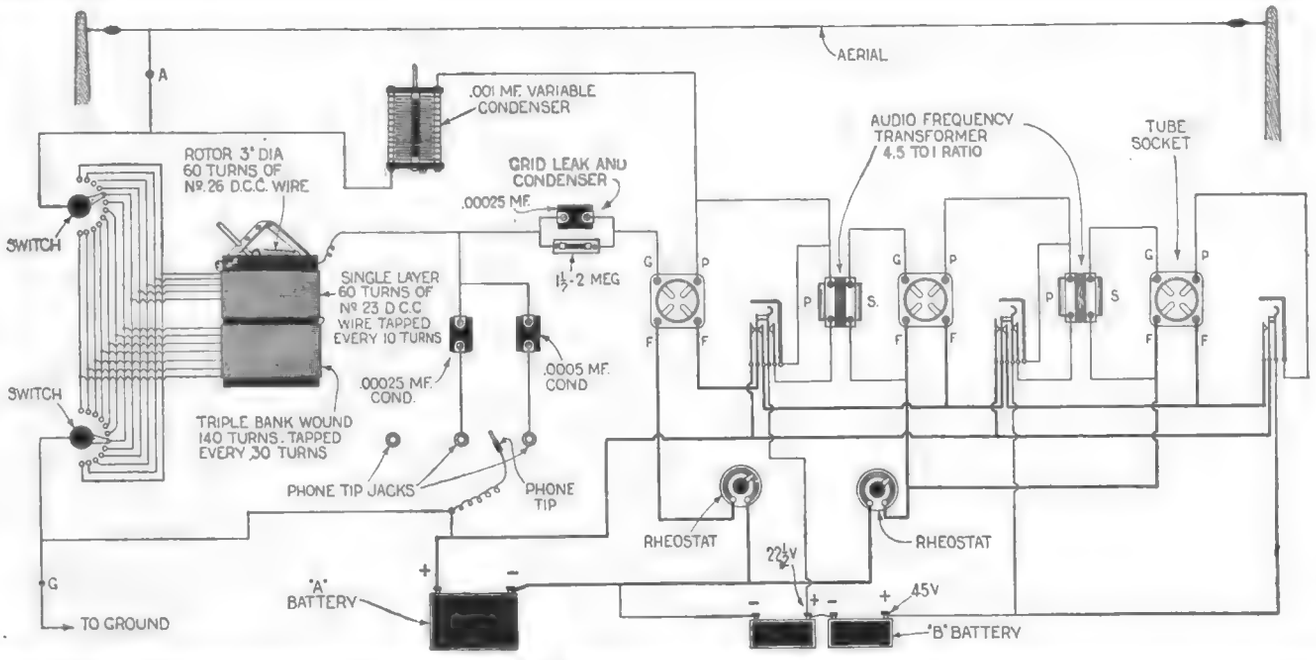
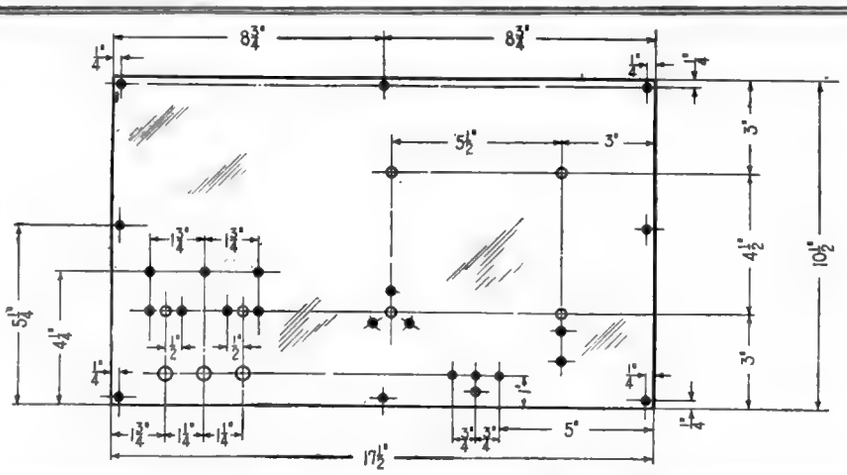
Multi-Wave Reinartz Receiver

By KENNETH HARKNESS



The Reinartz Tuner is without a doubt the best type for the reception of C.W. and I.C.W. signals. It gives excellent results on radiophone reception. The data on a Reinartz coupler of 3000 meters is given above. The top end of the stator, in the diagram, is connected to one side of the rotor, and the other side of the rotor to the grid. The jacks plug the two small fixed condensers into the circuit as shown above.

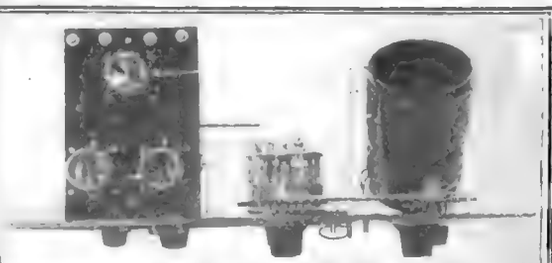


MATERIAL REQUIRED FOR THE MULTI-WAVE REINARTZ

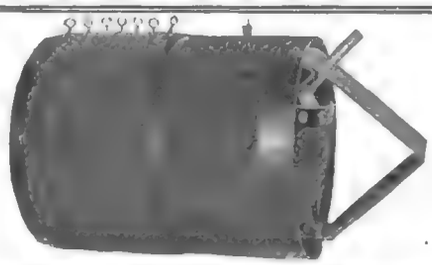
1 .001 m.f.d. variable condenser.
1 multi-wave coupler (details of winding in Fig. 1).
2 12 point (back of panel) inductance switches.
2 rheostats.
2 vacuum tube sockets.
2 double circuit automatic filament control jacks.
1 single circuit automatic filament control jack.
2 .00025 m.f.d. fixed condensers.
1 .0005 m.f.d. fixed condenser.
1 panel 17½ x 10½ x 3-16.
1 panel 5½ x 7 x ¼.
5 binding posts.

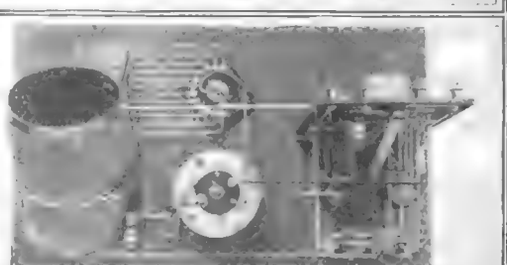
It is well to remember in selecting apparatus for use in this circuit that the better the apparatus you purchase, the better your results will be and the more satisfactory service your set will give.

Above is shown the panel lay-out for the multi-wave Reinartz receiver. This panel is used with a standard all-wave coupler such as shown at the right, second illustration from the bottom of this page. The two switch sets are to be connected in parallel so that any section of the coils may be used as desired. The coupler used in this circuit may be wound on a 4-inch bakelite tube for the stator, following the data given. The finished coupler may be purchased ready made or may be wound as shown at the top of this page. Either one will give good results.

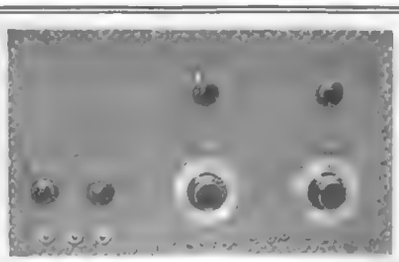


At left is a top view of the assembled all-wave Reinartz receiver, showing the position of the coupler, the variable condenser, and the three tube sockets.
At right a photograph of the finished all-wave coupler.
The rotor should be placed so that it may rotate through 180 deg.





At left is a rear view of the tuner, showing the locations of the jacks, transformers and other apparatus.
At the right is a front view of the finished tuner. In the placing of the instruments it is necessary to exercise great care so as to be sure that the bus bar wiring can be run the shortest way.



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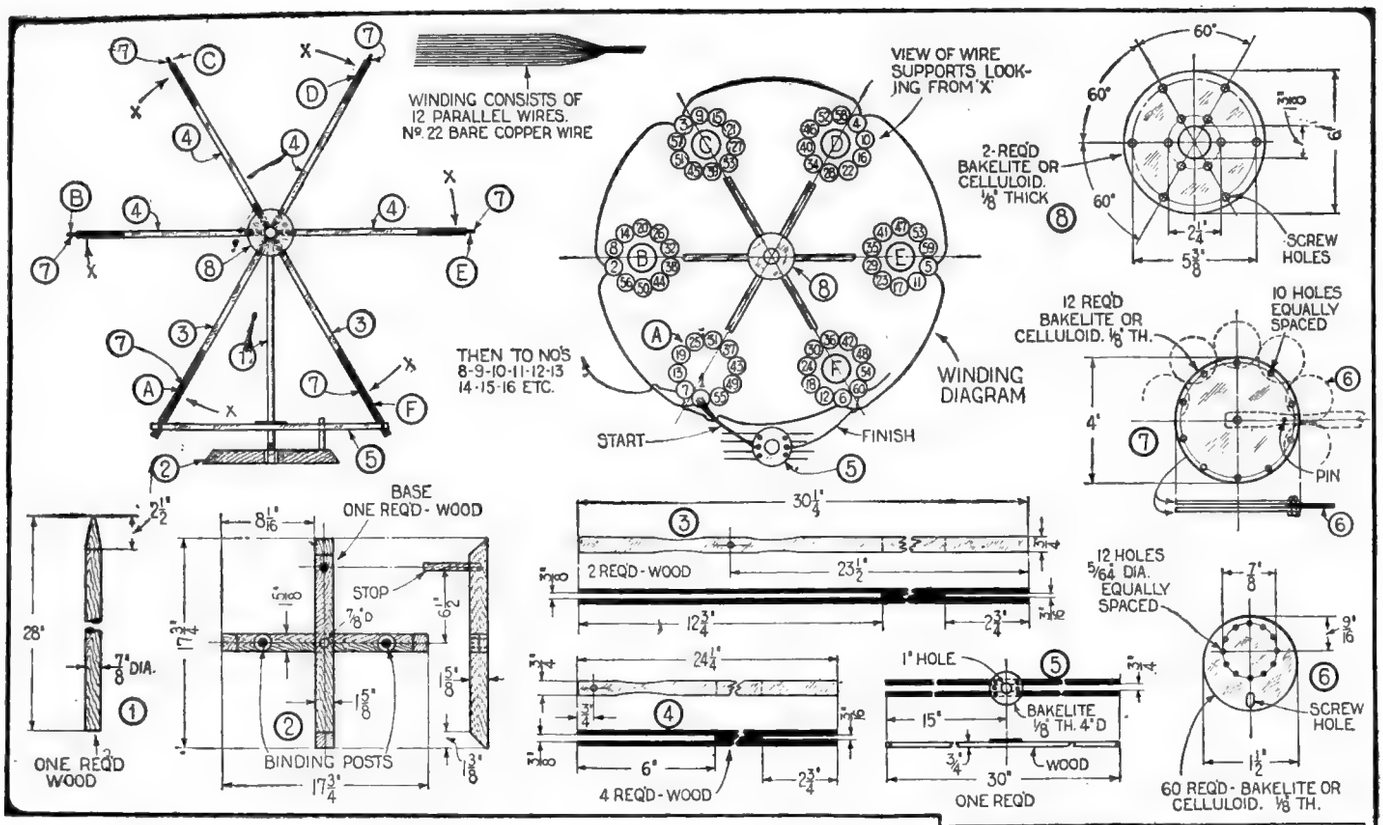
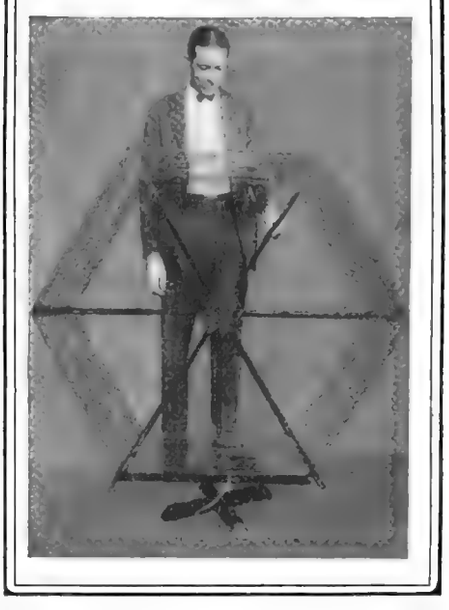
How to Build a Rogers' Cage Loop

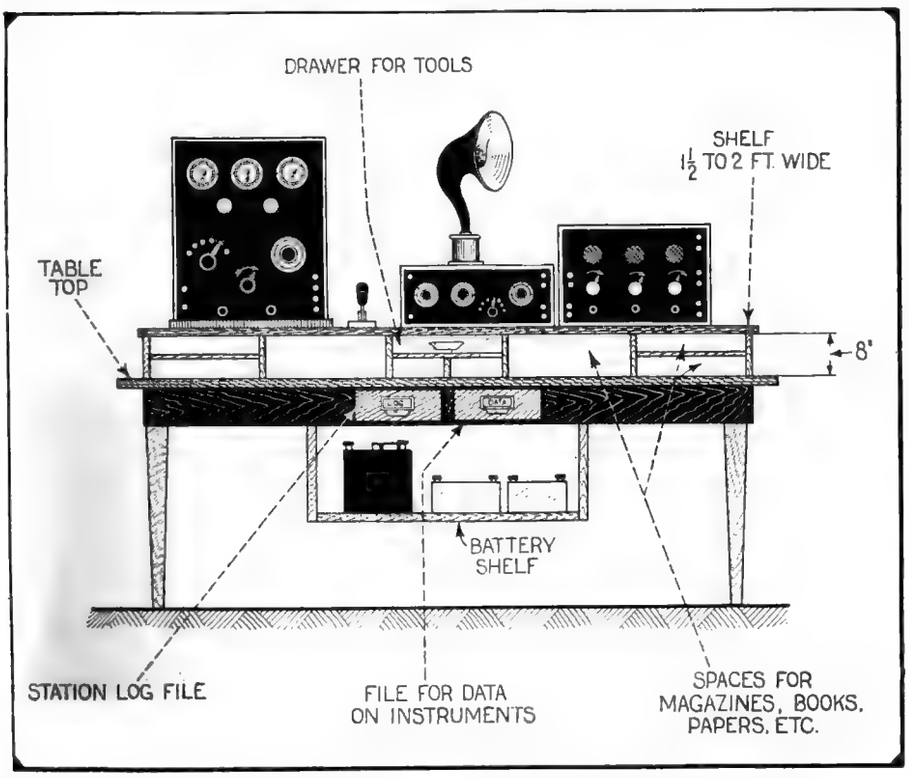
Full Details of Cage Loop Aerial Designed by Dr. James Harris Rogers.



The drawings and photo above show exact details for building the Rogers' cage loop antenna. This loop has been tested in the Radio News Laboratories, and has proven very efficient. It brings in signals approximately twice as strong as a single wire loop of the same size. This loop has a natural wave length of 246 meters. When it is shunted by a .0005 variable condenser, it has a wave-length range from 260 to 550 meters. When shunted by a .001 M. F. condenser, its wave-length runs to about 700 meters. The main advantages of the new loop are very low radio-frequency resistance, owing to the cage construction, and low distributed capacity due to the spacing of the wires. The results obtained with this loop show that even the ordinary loops can be greatly improved by winding them with the largest stranded or woven copper ribbon or tubing available.



A Business-Like Radio Table



Above will be seen a suggestion for the arrangement of a table with spaces provided for the filing of magazines, papers and other equipment which usually clutters up the table of amateur Radio stations. Drawers may be provided with card indexes for call letters and other data. Under the table, a shelf should be provided upon which may be placed the "A" and "B" batteries and the battery charger. This keeps them off the floor and prevents a tangle of wires in which one's feet are liable to be caught.

—By Thomas W. Heine.

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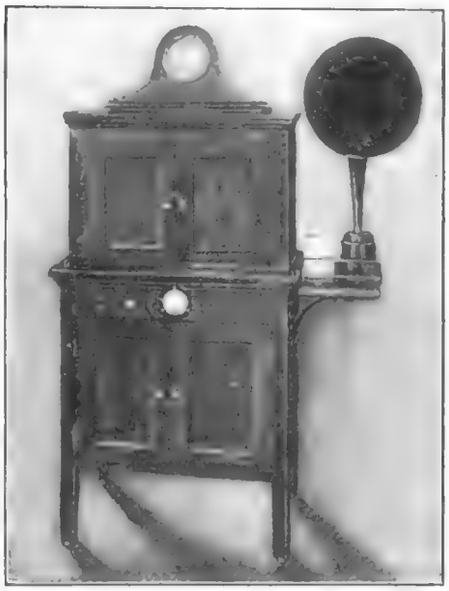
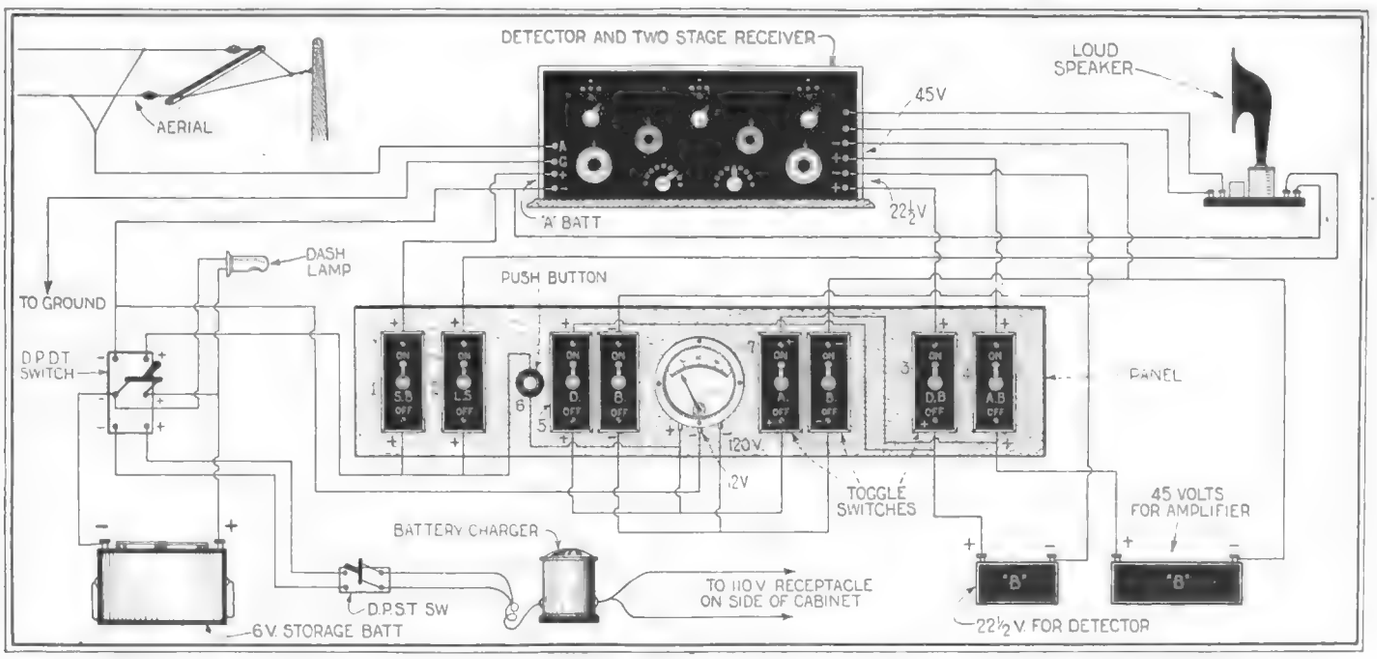
Well Made Radio Cabinet

At the left is shown the radio cabinet of Harry Huntley. The receiver with its detector and two stages of amplification is housed in the top of the cabinet. The storage and "B" batteries, together with a battery charger and a bottle of distilled water are housed in the bottom of the cabinet. There is a voltmeter and a series of switches mounted in the center panel. The loud speaker sits on the shelf at the side.

At the right is shown the cabinet closed. In this position it makes a piece of furniture of which anyone might be proud. The switches along the center panel operate the batteries and the loud talker. A push button throws the voltmeter in circuit. The circuits are so arranged that the storage battery is thrown from the set into the charging circuit by means of a double-pole double-throw switch. Changes from detector, to one stage of amplification or two stages of amplification are also made by throwing switches on the center panel. The bottom of the cabinet also contains a hydrometer.

At the bottom is shown the composite connections in this extremely well constructed set. Note the diversity of the circuits, even to the dash light, and how they are all controlled through the central panel, an idea many amateurs might do well to copy.





Liquid Air In Vacuum Tube Work

radio vacuum tubes, using mercury vac- Western Electric Co. uses a liquid air trap mercury vapors from returning to the t the right is shown the liquid air "still" in operation.

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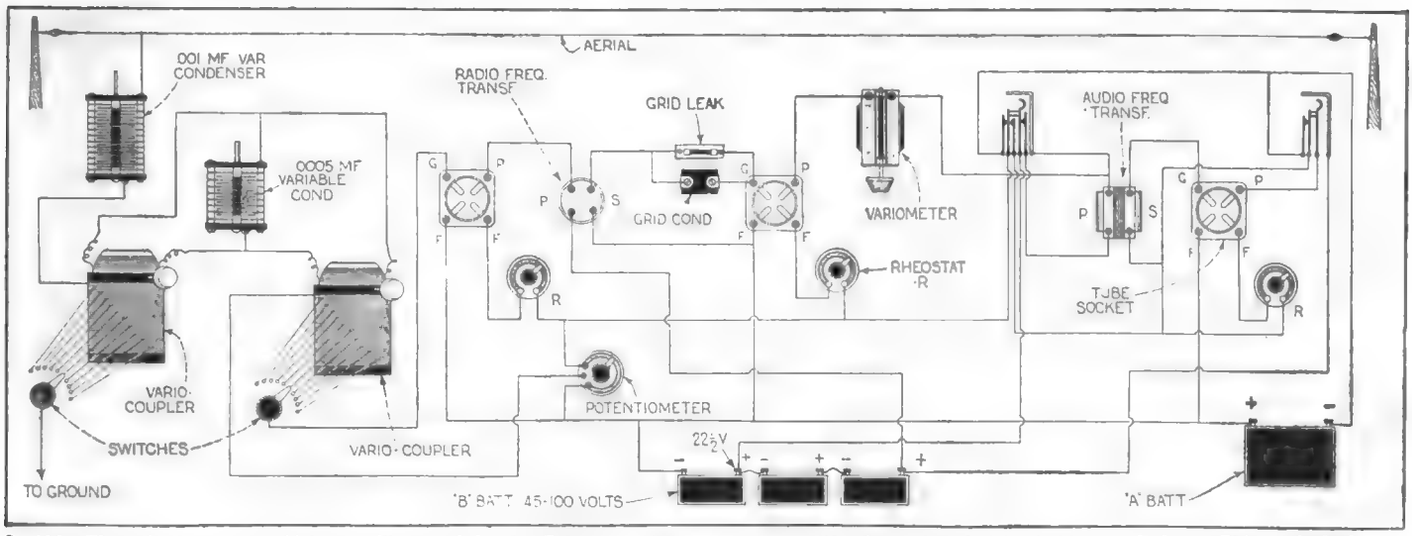
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c is made for all questions where a personal answer is desired.



Q. 196. The selective tuner which was illustrated in the February, 1923, issue of this magazine may be used in connection with one stage of radio frequency amplification, a vacuum tube detector, and one stage of audio frequency amplification, using the circuit illustrated above. This method of connecting the instruments will give extremely sharp tuning under all conditions and regeneration is accomplished by means of the variometer.

ONE STAGE R. F. AND STAGE A. F. AMPLIFICATION

(196) Joseph C. Haggenbart, La Crosse, Wisconsin, asks:

Q. 1. Can you show me how to connect one stage of radio frequency and one stage of audio frequency amplification to the circuit diagram shown in Fig. 4 on page 990 of the February, 1923 issue of SCIENCE AND INVENTION, using filament control jacks?

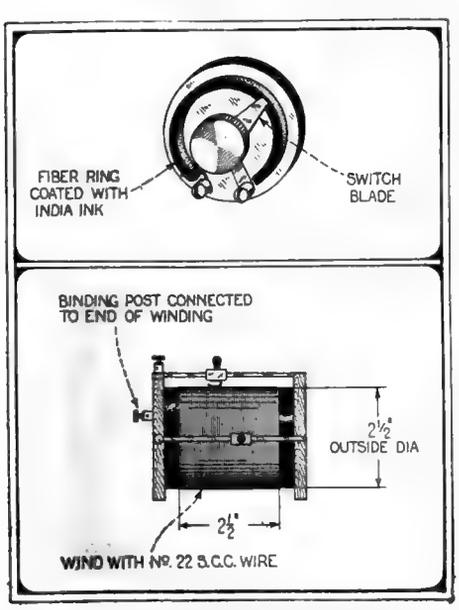
A. 1. You may connect your instrument as shown in the diagram in these columns.

VARIABLE GRID LEAK

(197) A. K. Force, Middletown, N. Y., wants to know:

Q. 1. How can I make a fairly serviceable variable grid leak which will give a constant variation such as is not obtained in those leaks using switch points?

A. 1. You will find in these columns an illustration which will aid you in constructing such a variable grid leak. The basis of the instrument is an old rheostat of the type making use of a fibre ring upon which the resistance wire was wound. The wire is removed and the upper edge of the fibre ring filed smooth. This edge is then coated with several coats of India ink, each coat being allowed to soak into the fibre. This process will be assisted greatly if the ink is applied while warm.


FIBER RING COATED WITH INDIA INK
SWITCH BLADE
BINDING POST CONNECTED TO END OF WINDING
2½" OUTSIDE DIA
2½"
WIND WITH No. 22 S.C.C. WIRE

Q. 197. The top illustration shows the constructional details of a variable grid leak.
Q. 198. The lower diagram gives all the necessary data for a two slide tuner, for use on the lower wave-lengths.

DATA ON TWO-SLIDE TUNER

(198) Lawrence Higgins, Chicago, Ill., requests:

Q. 1. Kindly give accurate data for the construction of a two-slide tuner capable of tuning to 600 meters when shunted by a variable condenser with a capacity of .0005 mf.

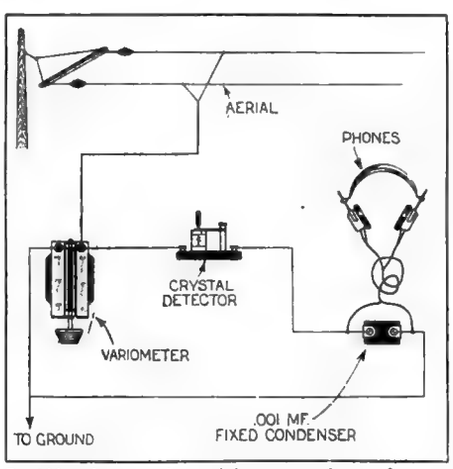
A. 1. You will find a diagram in these columns giving all the necessary data on the instrument you mention.

SINGLE CONTROL RECEIVING SET

(199) George C. Stewart, Cincinnati, Ohio, asks:

Q. 1. Can you give me a circuit diagram showing how to connect up the instruments necessary for a single control receiving set using a crystal detector?

A. 1. In these columns there is a diagram showing how to connect up a variometer with a crystal detector and a fixed condenser. This probably is the simplest type of receiving set that it is possible to construct and operate. The only control is the variation of the variometer.



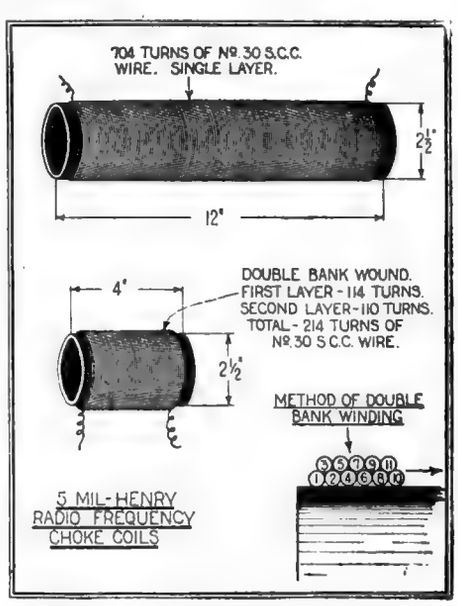
Q. 199. A crystal receiving set using only one tuning control may be connected as illustrated above. Selectivity is not very high, but the volume obtained is very good.

5 MIL-HENRY INDUCTANCES

(200) Arthur M. Van Wick, Richmond Hill, N. Y., requests:

Q. 1. Can you give me accurate data on the construction of a 5 mil-henry inductance or radio frequency choke coil, both single layer and double layer wound?

A. 1. A diagram in these columns gives all the necessary information. The method of bank winding a double layer coil is also indicated.


704 TURNS OF No. 30 S.C.C. WIRE. SINGLE LAYER.
2½"
12"
4"
DOUBLE BANK WOUND.
FIRST LAYER - 114 TURNS.
SECOND LAYER - 110 TURNS.
TOTAL - 214 TURNS OF No. 30 S.C.C. WIRE.
2½"
METHOD OF DOUBLE BANK WINDING
5 MIL-HENRY RADIO FREQUENCY CHOKE COILS

Q. 200. In various radio receiving and transmitting circuits, it is necessary to use radio frequency choke coils. Two methods of winding a 5 mil-henry choke coil are shown above, one using only a single layer of winding and the other two layers, bank wound.

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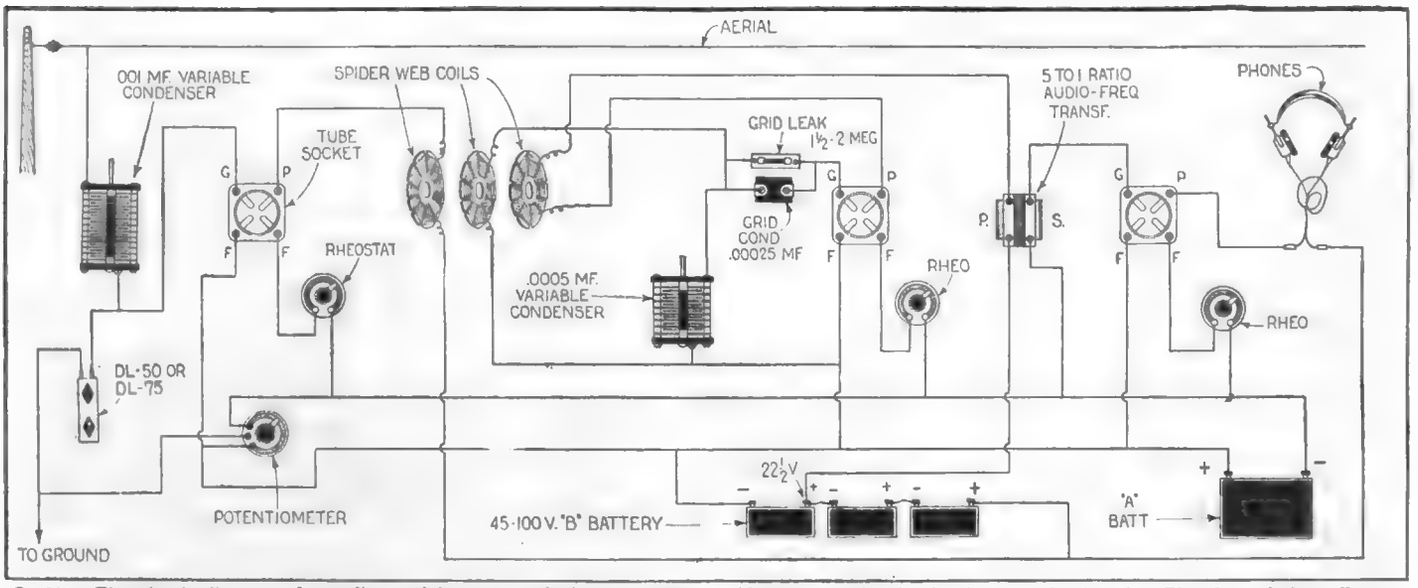


Q. 201. The circuit diagram of a radio receiving set employing one stage of tuned radio frequency amplification, a vacuum tube detector and one stage of audio frequency amplification, appears above. The tickler coil provides regeneration in the detector circuit only. The sizes of the coils must be determined by experiment and be adapted to the wave-length it is desired to receive. This circuit gives excellent selectivity and is good for D.X.

R. F. AND A. F. AMPLIFICATION

(201) Harold C. Vender, Sacramento, Cal., wants to know:

Q. 1. Can you show me how to connect up one stage of radio frequency and one stage of audio frequency amplification using three spiderweb coils between the radio frequency amplifier and the detector?

A. 1. In order to do this, it is necessary to tune the antenna circuit by means of a variable condenser and a fixed or variable inductance. A diagram is shown in these columns putting forth all the necessary connections and all the data will be found thereon.

VARIOMETER AND TICKLER COIL

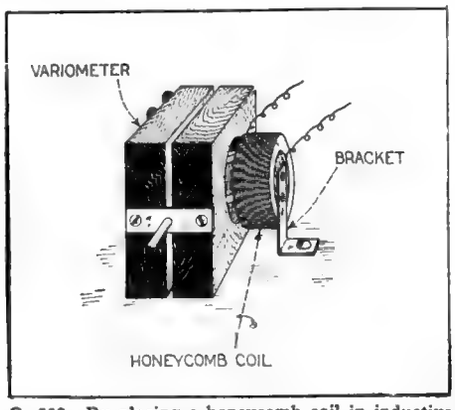
(202) Frank Prell, Osceola, Nebraska, wants to know:

G. 1. What would be the best way to use a variometer for the tuning inductance and a honeycomb coil for the tickler coil so as to produce regeneration?

A. 1. A honeycomb coil placed in inductive relation to your variometer as illustrated in these colums, could very readily be used to obtain regeneration in a radio receiving circuit. If the bracket used for supporting the honeycomb coils was so arranged that the inductive relation between the variometer and the tickler coil could be changed at will, better results would be obtained.

Q. 2. Should a switch be used in the "B" battery circuit so that the current may be cut off when the set is not in use?

A. 2. A switch in the "B" battery circuit is advisable in order to eliminate any chance of short-circuiting the "B" battery while changing connections or otherwise working on the set.

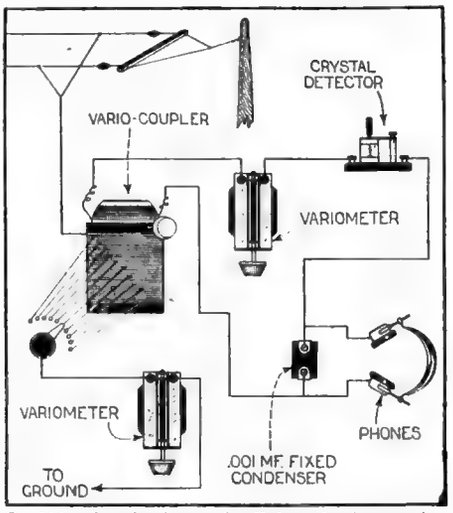


Q. 202. By placing a honeycomb coil in inductive relation to a variometer as shown above, regeneration by the feed-back principle will be obtained.

CRYSTAL RECEIVING SET CIRCUIT

(203) W. M. Riggs, Cincinnati, Ohio, asks:

Q. 1. How can a short wave regenerative tuner, employing two variometers and a variocoupler be used with crystal detector?



Q. 203. A selective and efficient hook-up using a crystal detector is shown above.

A. 1. The circuit diagram found in these columns shows the necessary connections. This circuit is, of course, not regenerative.

VARIOMETER CONNECTIONS

(204) Ward Stanley, Oakes, North Dakota, requests:

Q. 1. How are the two coils of a variometer wound, and how are they connected together?

A. 1. The two coils of a variometer are always wound in the same direction and they are connected in series with each other, as illustrated in these columns.

LIMIT TO WAVE-LENGTH

(205) J. E. Peters, Hartman, Ark., requests:

Q. 1. Can you tell me what the limit of the wave-length of a tuning coil is and does the wave-length to which it will tune affect the receiving range?

A. 1. The limit of the wave-length for a tuning coil depends upon the size of the core, the amount of wire and the size of the wire wound thereon. Increasing the wave-length will not increase the receiving range in the least. These two factors are entirely distinct from each other.

VARIOCOUPLER QUERY

(206) Joseph Scafede, Pittsburgh, Pa., asks:

Q. 1. Should the secondary of a variocoupler be wound on a tube of the same size as the primary, or of different size?

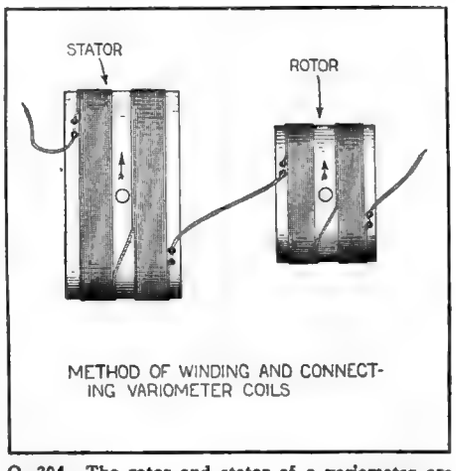
A. 1. In constructing a variocoupler, the secondary must be wound on a tube much smaller than the primary tube, in order that it may rotate. Wooden standards or supports may be fastened on the outside of the primary, through which a brass rod is passed, to which rod the secondary is fastened.

BUZZER TEST

(207) Fred H. Sander, Malden, Mass., wants to know:

Q. 1. What is the best way to test the minerals used in a radio receiving set?

A. 1. The best system for testing radio receiving crystals is to use a high-pitched buzzer. This buzzer should be placed in a box, and packed in with cotton, so as to reduce the amount of mechanical sound produced. Leads are brought out from the two binding posts of the buzzer and connected to a battery and switch, and a third lead is brought out from the contact point of the buzzer. If a single circuit tuner is used, connect this third lead to the ground connection of the set. If an inductively coupled tuner is used, connect the third lead directly to one post of the detector. Now, by turning on the switch, and adjusting the cat whisker over the surface of the mineral, a loud buzz will be heard when the cat whisker is on a sensitive spot.



Q. 204. The rotor and stator of a variometer are always wound in the same direction and connected as shown above.

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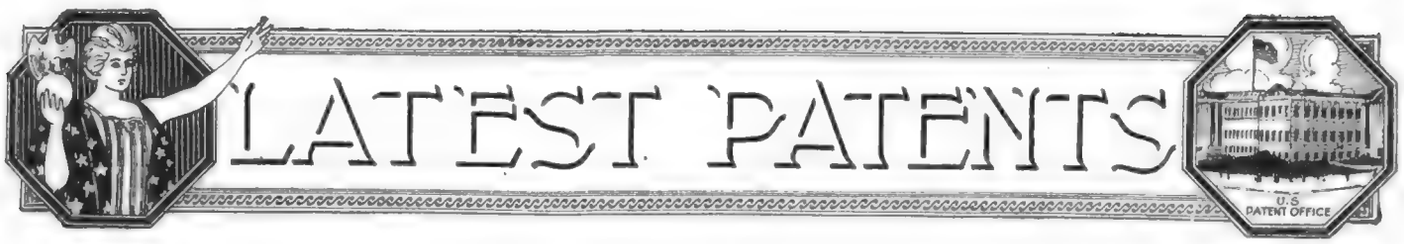
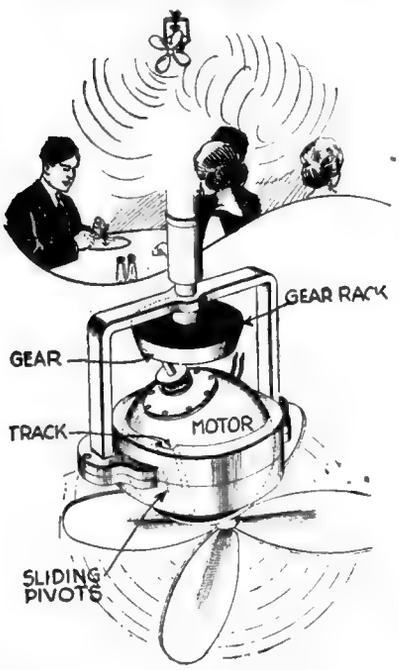
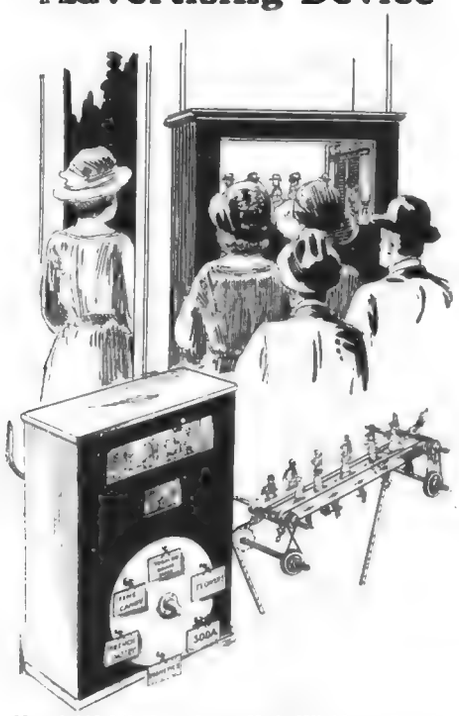


Oscillating Fan



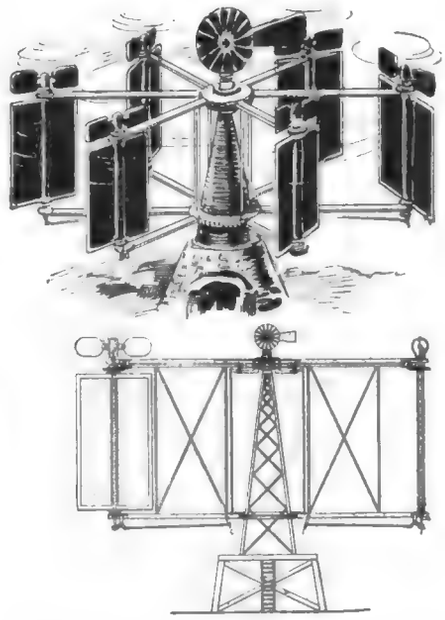
No. 1,456,433 issued to Maurice M. Glasser. This arrangement for a ceiling fan causes the fan to oscillate. The motor rocks up and down in a slot where a sliding pivot guides it. Opposite the fan on the shaft of the motor is a gear and rack, which causes the fan to swing in a circle.

Advertising Device



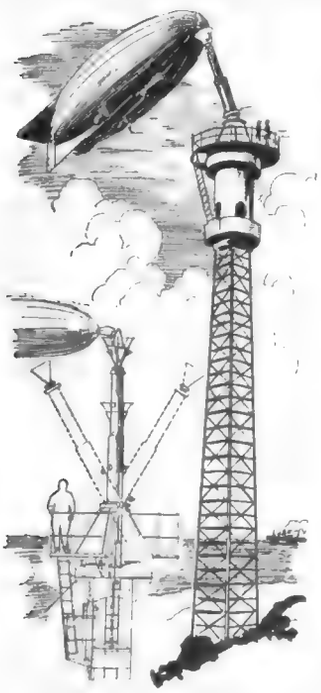
No. 1,446,680 issued to Ned Winkler. In this window display a number of figures are mounted on two endless belts traveling in opposite directions. The figures enter a store, and then leave the store laden with bundles. A disk rotates below and display placards are exposed.

Wind Wheel



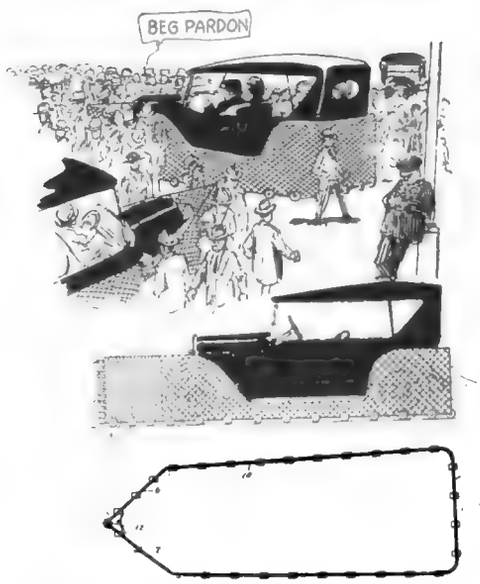
No. 1,445,367 issued to Frank A. Stirtan. The invention illustrated obtains a maximum efficiency from wind wheels. The invention contemplates the use of a vertically pivoted rotor carrying a number of sails which act in synchronism as the rotor revolves to present the maximum sail surface.

Airship Mooring



No. 1,448,088 issued to George Herbert Scott. The mooring mast illustrated is fitted with an arm on top of the mast head, which is telescopic in nature and which has complete azimuthal freedom. It is thus able to assume any inclination within limits of course. The airship nosing down to the top of the mast is coupled to it by means of male and female plugs, and the shock of the landing taken up by the swinging tube and by springs which tend to maintain this in a horizontal position.

Automobile Fender



No. 1,444,558 issued to Max Scheftel. Perhaps if the traffic gets much more dense than it is at present in some of the larger cities, we may find it necessary to drive around in automobiles equipped as illustrated in the above drawing. The inventor has designed a fender which runs along the ground on tiny rubber tired wheels. It is entirely made of wire screening and surrounds the automobile completely. It is evident that an automobile equipped with such a fender could not possibly severely maim or injure anyone in its path; particularly would this be true if the device was sufficiently heavy to prevent the automobile from increasing its speed. It cannot be doubted that such a device affords perfect protection to the car itself.

Cigarette Extinguisher

No. 1,464,998, issued to Charles F. Pratt. This is an interesting little novelty for extinguishing cigarettes. A sponge is supported on either side in a receptacle containing water. When placing a cigarette or cigar into the hole in the top of the container, the water on the sponge automatically extinguishes it. The cigarette may then be dropped into the container.

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Scientific Humor

The Short Sir Quit.—REMUS: "Whar yo' all g'wine wid dat baby food, Mose?"

MOSE: "Mah wife Dinah give me a son las' night."

REMUS: "Dasso, what you g'wine call him?"

MOSE: "Lectricity."

REMUS: "Am he as shockin' as dat?"

MOSE: "No, but what ailse can we call him when he comes from Dinah-Mose?"—*Bison.*

We Want to Know.—What makes a piston ring?

How much does the Milky Way?

Where does the Gulf Stream?—*Rice Owl.*

A Befitting Answer.—RASTUS: "Ah can't get dis spot off'n yo' trousers."

STUDENT: "Have you tried gasoline."

RASTUS: "Yas, suh."

STUDENT: "Have you tried ammonia?"

RASTUS: "Naw suh, but I'm almost sure they'll fit."—*Yellow Jacket.*

Some Distance. — FIRST RADIOPHAN: "Just think, I got Paris last night."

SECOND RADIOPHAN: "And I got London."

THIRD RADIOPHAN: "And I listened in until two o'clock this morning and got h——l."—*Carl C. Sattell.*

A Direction Finder.—LITTLE JACK: "Say Ma, what did pa mean when he said he was the captain of this ship?"

MA: "Oh that's a polite way of letting us know that he is the head of the house."

LITTLE JACK (after a few moments' silence): "Well, if he's the captain, Ma, you're the pilot and I'm the compass."

MA: "Why the compass?"

LITTLE JACK: "Well ain't the captain and pilot always boxing the compass?"—*Harry Rowe, Jr.*

Let's Get At 'Em!—PROFESSOR: "Tell about atoms."

STUDENT: "Why—er—Adam was the first man!"—*Frank Gibson.*

Yes, Without Aerials. — MRS. DORCAS: "Women are more clever than men."

DORCAS: "In some ways. At any rate, they used to broadcast things from the housetops long before we'd ever heard of the radio."—*Jas. J. O'Connell.*

Wisdom at Large.—PROFESSOR (to Biology class): "Now these bacteria are largely very small though a small number of them sometimes grow to be very large for their size."—*Randolph Howorth.*

Wired Wireless. — CRAWFORD: "Mrs. Snooper quarreled with her husband about having a wireless?"

CRABSHAW: "He told her he was sure she could listen in all right without going to the expense of a radio set."—*Jas. J. O'Connell.*

The Merry Go Round.—PROFESSOR: "Describe centrifugal motion."

STUDENT: "That's the way your head feels after drinking some of this Anti-Prohibition hooch!"—*Frank Gibson.*

First Prize $3.00

An Eye Opener.—The Henry F —— Co. was holding an executive meeting. They were trying to devise a new door for their car, which would look a little different from the present one, because D..... Bros. had just put out a car with doors that looked like theirs. Nobody had any suggestion to offer. Finally the chairman decided to send a telegram to their absent assistant engineer.

Next day back came an answer to the telegram: "Build it solid and send a can opener."—*William J. Murphy.*

A Noisy Transmitter—IRATE CITIZEN (from his bedroom window): "Say you down there; who are you talking to?"

INTOXICATED ROMEO: "Nobuddy n'perticerler. I'm jesh broadcashtin'."—*Agwan.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. No letters acknowledged unless postage is included.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to "tie" for the prize, then the sum of three dollars in cash will be paid to each one.

Wrong (.) Indigestion.—TEACHER: "Is there any connecting link between the animal and vegetable kingdom?"

WILLIE: "Yes, ma'am. Hash."

Impossible to Exterminate Them.—STOREKEEPER: "No, we don't sell radio powder, what do you want it for?"

CUSTOMER: "For radio bugs."—*Sidney Lang.*

Patent Applied For.—The city motorist was indignant. "How do you know if I was exceeding the speed limit when you haven't a watch or anything?" he demanded.

"Wal, ye seen that yeller dog a chasin' ye, didn't ye?" inquired Constable Slackputter amicably. "When that dog can't keep up with a feller, the feller's a goin' more'n thutty miles an hour."—*Fred Brewster.*

A Light Tale.—SHE: "What is the smallest tail light you have ever seen?"

HE: "Oh! The one on a Ford."

SHE: "Not on your life, What about the tail-light of a firefly."—*Randolph Howorth.*

A Super-Expert.—"You say the efficiency expert you hired is cutting down every salary except his own. Do you think that fair?"

"It will be," replied the manufacturer. "As soon as he gets through I'm going to fire him."—*Jas. J. O'Connell.*

Broadcasting a Joke.—"That's a pretty good joke," exclaimed the radio operator after somebody had sprung a hot one.

Then, reaching for his instruments he added thoughtfully, "I'll tell the world."—*Harry Richter.*

He'll Ring Her Neck.—Modern inventions play an important part in our every-day life. A telephone, for example, is an innocent looking tool yet it causes many complicated situations.

Friend wife was visiting her mother and dear "hubby" was endeavoring to survive as best he could. Each evening by means of the telephone they learned the good or bad news of the day. On a certain eventful evening during the course of the conversation the wife inquired of her devoted mate as to his actions of the present moment. Being a truthful chap our hero replied that, if the truth was demanded, he was washing his B. V. D.'s. At this junction Central sung out in an awe-inspiring voice, "I'm ringing them for you!" Whereupon the family cat turned a back somersault and another divorce case was in the offing.—*Tiger.*

Correct.—BOY (Pointing to an Electric Meter): "Pop, what's that thing?"

POP: "Oh! that's an Electric Racer."—*Carl C. Sattell.*

A Shirt-Waste—In a small town a resident calls central for a number. Central does not answer promptly, so the man forgets the number while waiting.

CENTRAL (At last): "Number."

RESIDENT (In his long wait): "I forgot the number, so keep your shirt on until I find it."

This makes central very angry and she tells the manager, who next day tells the resident that he must call central and apologize or his phone will be removed.

The culprit calls central, saying: "Is this the lady whom I told yesterday to keep her shirt on."

CENTRAL (Snappy): "Yes, I am."

RESIDENT: "Well you can take it off now."—*Fisher H. Carlile.*

Hooched Up.—FIRST INEBRIATE: "Shay, Bill, what do they call a connection for a radio set, a— a— what?"

SECOND DITTO (Staring blankly): "Hic-up!"

FIRST INEBRIATE: "Thash it—Hook up!"—*F. T. Peterson.*

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THE ORACLE

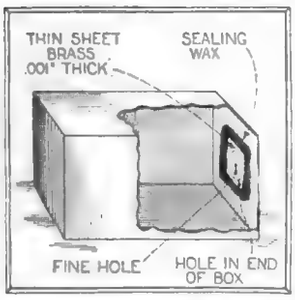
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

THE PIN-HOLE CAMERA AGAIN.

With reference to the pin-hole camera described in this department in the October, 1923, issue, one of our correspondents, Mr. Allen B. Garratt, has offered further information on the same.

He states that instead of drilling or punching a hole directly in front of the box used, that a



An improved design pin-hole camera is shown here. Instead of punching the hole directly in the front of the box the hole is made by running a needle through a very thin piece of brass or foil.

piece of very thin sheet brass, tinsel or tinfoil should be used, in the center of which is punched a fine hole with a needle. Both sides of the plate sheet are then to be rubbed down on a fine oil-stone, taking off any burr, whereupon a very nearly perfect hole will result. This strip of brass is to be fastened on the inside of the camera box as illustrated herewith, after a hole about one inch in diameter has been bored in the box. The sheet of metal is to be fastened on with sealing wax, making sure that a perfectly light-tight joint is obtained.

Mr. Garratt also stated that both sides of the brass sheet should be blackened, as well as the edges of the hole. He advises the use of lamp black in turpentine with a few drops of varnish added.

Here is shown a method of winding a non-inductive resistance. By winding the turns back over each other as shown in the sketch the self-inductance of the coil is practically eliminated.

THE ELECTRIC CARILLON

ALSO called electric Chimes, can be made by any experimenter within a few hours. Most of the material will be found about the house as all you need are a few bells and some old bottles. Beautiful music can be played upon the Carillon. This instrument is described fully in the December issue of PRACTICAL ELECTRICS together with the following interesting articles.

TRICK SHUFFLE BOARD
ECHO DEEP-SEA SOUNDING.
ELECTRIC BASEBALL SCORE BOARD
By Samuel Fariss
MAMMOTH FAN
HIGH VOLTAGE TRANSMISSION
By F. W. Peek, Jr., Consulting Engineer, General Electric Company
VOYAGING BEYOND THE VISIBLE
By M. R. McCabe
HOUSE BELL AND ALARM CIRCUIT
By J. M. Bellaire, Paris Correspondent

NON-INDUCTIVE RESISTANCE

(1584) J. C. Thomas, Arlington, New Jersey, wants to know:

Q. 1. What is meant by a non-inductively wound resistance and how is such a coil to be made?

A. 1. A non-inductive resistance is one in which successive turns have little or no inductive effect on each other. Such a coil is wound as illustrated herewith. The wire is measured off for the required resistance, doubled, and wound in coil shape from either end, connecting the two ends of the wire to suitable terminals, according to the type of apparatus in which the resistance coil is to be used.

This method of wiring resistance is used where non-inductance is desired such as in the resistance coils of a Wheatstone bridge or a standard resistance box used in calibrating other instruments in the laboratory.

MODEL MARINE ENGINE

(1585) E. Edmunds, Hoboken, New Jersey, asks:

Q. 1. Can you tell me where to obtain actual working drawings for the construction of a model marine engine suitable for propelling a hydroplane or other model boat about four feet long?

A. 1. Upon receipt of a stamped addressed envelope we will supply the name and address of a company who supplies such a set of complete drawings at a nominal price.

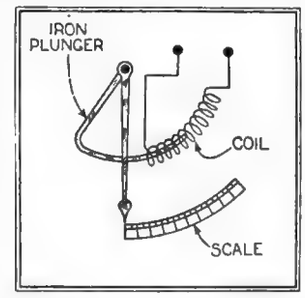
SOLENOID TYPE OF METER

(1586) R. D. Sloane, Chicago, Ill., asks:

Q. 1. What is the principle of the common ammeter and volt-meter such as those known as the watch-case type?

A. 1. The illustration herewith shows such a meter, which depends upon solenoid action. The

Here is illustrated a solenoid type of volt-ammeter. The variation in the strength of the current affect the power of the solenoid's action upon the iron plunger to which the indicator is attached.



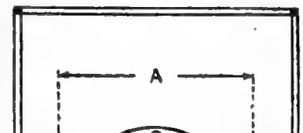
coil of wire is the solenoid and the curved strip of iron is the plunger. When current passes through the coil, the iron plunger is drawn within it, by the magnet action, to a greater or lesser extent. This, of course, indicates on a scale as the shaft carrying the iron plunger is firmly affixed to the pointer. In common practice, ammeters are wound with comparatively heavy wire on the solenoid coil, while volt meters have a very fine wire.

DIVIDED CIRCUIT

(1587) L. K. Kennedy, Plainfield, N. J., wants to know:

Q. 1. What is meant by a divided circuit in electrical work?

The amount of current carried by each of two conductors in a common circuit where the circuit is divided, as shown in the sketch, is in inverse ratio to the resistance of each conductor.



OUR $12,000 PRIZE CONTEST

THE next issue of SCIENCE AND INVENTION will witness the first issue in which we will award prizes to our correspondents and contributors for the best articles submitted during the month. From the way the manuscripts have been pouring in, we feel sure that the January issue will eclipse all former ones; and we have been receiving some mighty good material too. Our correspondents are scouting the field far and wide, and those that stay at home have thought up a host of novel things, many of which you will find in the January issue.

ARTICLES TO APPEAR IN JANUARY SCIENCE AND INVENTION.

How to Make Butterfly Trays,
By Dr. Ernest Bade.
Heat From the Stars—How It Is Measured by Sensitive Thermo-Couples,
By Edison Pettit, Astronomer, Mt. Wilson Observatory.
Facts About Oil and Coke Fuel for House Furnaces,
By H. Winfield Secor.
The Latest Developments in Automobiles.
Raising Sunken Ships by Freezing Them in a Block of Ice.
The Latest Attempts at Perpetual Motion.
The New Contra-Propeller for Airplanes and Ships.
At the County Fair—How Scientific Gambling Devices Separate the Public From Their Money By W. C. Kelly.
New Reflected Stage Lighting Approaches Daylight, By A. P. Peck.
The Secret of the Submarine City—No. 25 of Dr. Hackensaw's Secrets.
By Clement Fezandie.
Largest Artificial Lightning Machine for the Movies. By Phil Gersdorf.
Wireless Energy for Autos and Trains.
Two Remarkable New Steam Turbines.
Over Forty Radio Articles—Giving the Latest Developments in Commercial Apparatus and How-to-Make-it Ideas.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION, we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope.

Address all inquiries of this nature to **INFORMATION EDITOR** c/o Science and Invention, 53 Park Place, New York City.

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A. 1. When two conductances of certain resistances, either equal or unequal in value are joined in parallel, as illustrated in these columns, the current passing through the entire circuit will divide itself between the two conductors. The amount of current passing through each one will be in inverse proportion to the resistances of the wires B and C.

The ability of any circuit to conduct an electrical current is represented by its conductance, which is the reciprocal of the resistance. The conductance of a divided circuit is equal to the sum of the conductances of its various parts. Suppose that A is the sum of the resistances of the wires B and C. Then the joined conductance of the entire circuit equals $\frac{1}{A} = \frac{1}{B} + \frac{1}{C} = \frac{B+C}{BC}$

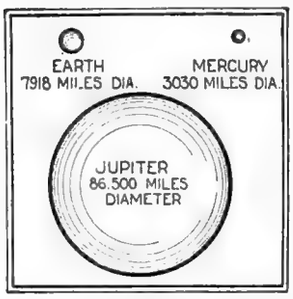
Now that we have the joint conductance, we can find the joint resistance by taking the reciprocal of the conductances we have for the resistance $A = \frac{BC}{B+C}$

From this we can state a rule as follows: The joint resistance of a divided circuit, or of resistances in parallel is equal to the product of the two separate resistances divided by their sum.

COMPARATIVE SIZES OF THE PLANETS

(1588) Frank Mayo, Boston, Mass., asks the Oracle:

Q. 1. What is the diameter of the smallest and of the largest planet of our solar system?



Mercury is the smallest planet in our Solar System and Jupiter is the largest. Their relative sizes together with the comparative size of the Earth is shown in the sketch. Mercury is the nearest planet to the sun.

A. 1. Mercury, the nearest planet to the sun is the smallest, of the planets usually so-called, measuring 3,030 miles in diameter. Jupiter is the largest, measuring 86,500 miles in diameter. The illustration herewith shows the comparative sizes of the Earth, Mercury and Jupiter.

NICKEL PLATING ANODES

(1589) Ben Benoit, Pasadena, Cal., asks:

Q. 1. What kind of anodes must be used in nickel electro-plating?

A. 1. The anodes used for this work must consist of nickel which is at least 99% pure. If there is a greater percentage of other metals present, the plating will be discolored and will not take a high polish.

WIRELESS POWER

(1590) J. G. Benvit, Montreal, Que., Canada, asks:

Q. 1. Has anyone ever succeeded in running small machinery at a distance by wireless, in other words, without having any metallic connection between the source of power and the apparatus?

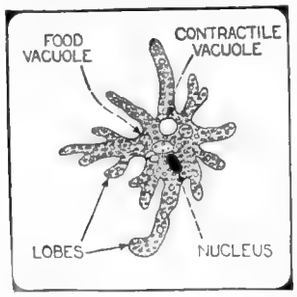
A. 1. Nikola Tesla has succeeded in running a small motor by wireless, and also in lighting several lamps. His experiments have been described from time to time in various past issues of SCIENCE AND INVENTION.

THE AMOEBA

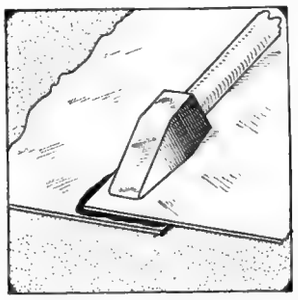
(1591) Louis Hoffmeister, Bronx, New York, asks:

Q. 1. What is the simplest form of animal life?

A. 1. The Amoeba, a microscopically small animal, is probably one of the simplest types of all animals, consisting of a single mobile cell-like structure and a nucleus. This tiny animal, illustrated herewith, moves by pushing out out-flowing lobes, which are merely a part of the body elongated, and then drawing itself up. Food is taken into the organism in much the same manner, the entire body of the Amoeba wrapping itself around the food, forcing it into the food vacuole. After assimilating the food, waste matter is thrown off through the contractile vacuole. This tiny animal resembles an irregularly shaped speck of grayish colored jelly and is about one one-hundredth of an inch in diameter.



This is the Amoeba, the simplest form of animal life. It is a mobile cell-like animal with a central nucleus. It propels itself with out-flowing lobes which are a part of its body. It resembles gray jelly.



One method of soldering—and a very good one, too, since it will withstand a great amount of strain, is shown here. The soldering iron must be very hot for this method, which is called "sweating a seam."

SWEATING A SEAM

(1592) Jack Wilbur, Roscoe, N. Y., wants to know:

Q. 1. What is meant by "sweating a seam" in soldering and how is it done?

A. 1. This term is used to designate the soldering of two metal strips or edges such as illustrated herewith. In doing this, a very hot soldering iron is used and is pressed on the top of the joint until the metals are hot. Solder is then allowed to flow between the faces of the metals to be united and the iron is held on the seam, so that literally, the solder sweats into the seam. The iron for this work must be very hot and the work done carefully in order to insure complete soldering of the joint. This makes a very tight joint and one which will withstand considerable strain.

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REMOVING SCRATCHES FROM GLASS

(1593) E. G. Adams, Rochester, N. Y., wants to know:

Q. 1. How can scratches be removed from plate glass without marring the surface?

A. 1. It is impossible to remove scratches from plate glass without grinding down the surface of the glass to a level with the bottom of the scratch.

Q. 2. Can hydrofluoric acid be used for this purpose?

A. 2. Any attempt to use hydrofluoric acid will leave a surface similar to ground glass, which must necessarily be polished thereafter.

EXPANSION OF AIR

(1594) Dominic Addeo, Long Branch, N. J., asks:

Q. 1. If a liter flask is heated from 50° F. to 70° F., what amount of air will be expelled therefrom by expansion?

A. 1. If a flask containing 1 liter of air is heated from 50° F. to 70° F., the volume of the gas will expand .05 liters and this amount will be expelled.

MAGNETIC ATTRACTION

(1595) R. S. Alexander, Avalon, Cal., wants to know:

Q. 1. Can you tell me of a chemical or a compound of chemicals that could be mixed into a paste with which an object could be painted, so that a person could be guided to this object by means of a compass being attracted by the composition used in the paint?

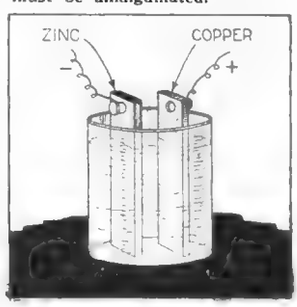
A. 1. The best and most reliable way for you to obtain the results you desire, would be to install a powerful permanent magnet at the point you desire a compass to be attracted to.

A magnet such as used on magnetos in automobiles and motorcycles, would attract a sensitive compass over a distance of probably five or six feet. This would be the only way that you could obtain this result, but if you made a mixture of iron fillings and glue, you could paint objects with it, and probably obtain an attraction over a distance of a fraction of an inch. This would be the very best you could do with any such paint or paste.

SIMPLEST ELECTRIC CELL

(1596) Jack Morrell, Long Island City, N. Y., says that he wishes to construct the simplest type of electric cell for demonstration. It must be one which does not require charging in order to deliver current.

A. 1. The voltaic cell illustrated herewith is probably the simplest type of electric cell which can be used for successful demonstration. It merely consists of a strip of copper and a strip of zinc immersed in an acid solution. Usually sulphuric acid is used. This cell will deliver about 1.05 volts, but will become polarized very rapidly under use. The polarization takes place when bubbles of hydrogen gas cover the surface of the copper plate. In order to restore the action, which is interrupted by polarization, the copper plate may be wiped off and replaced in the solution. The zinc must be amalgamated.



The simplest form of electric cell is shown here. It is merely a strip of copper and a strip of zinc immersed in a solution of sulphuric acid. Although the cell polarizes quickly it will deliver a little over one volt.

RECTIFIERS

(1597) John H. Barnes, Norwich, Conn., says that he understands that a crystal detector such as used in radio reception allows the current to pass through in only one direction. He asks:

Q. 1. Is it possible to fix a copper or other wire with some chemical compound so that the wire in question will allow a fairly large current to pass through in one direction and not in the other?

A. 1. Any of the rectifiers on the market today will perform the results you desire, but to our knowledge there is no way of obtaining the same result with some chemical or compound in the form of a wire. Many different kinds of substances used in radio work have the property of rectifying alternating currents, but only to a very slight degree. While they will rectify the extremely minute currents handled in radio telegraphy and telephony still they will not normally rectify any very great amount of curent.

There is an experimenter in this city who has constructed a modification of the radio crystal detector, using a piece of the well-known crystal silicon, through which he claims that he is able to pass nearly one ampere A.C. and obtain D.C. on the output.

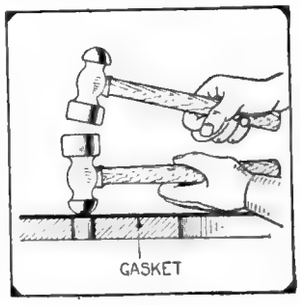
Not knowing just how you desire to use such an arrangement, we are unable to give you further information, but will be only too glad to advise further if the above will not suit your purpose.

PUNCHING GASKET HOLES

(1598) Leonard Bastin, Kansas City, Mo., asks:

Q. 1. What is the simplest way to make holes in gaskets for use on automobiles in such places as between the crank case and the cylinder casting?

A. 1. First, a sheet of gasket material of the required size must be obtained and cut to the shape of the top edge of the crank case. The resulting rectangular strip is then placed over the crank case and by means of two ball hammers, placed as shown herewith, a neat hole of exactly the right size will be cut in the material. Care must be taken to do this work carefully, in order that the material of the gasket will not be torn unnecessarily. By careful manipulation the same results may be obtained with a single ball hammer by tapping on the gasket material carefully around the edges of the hole until the sharp corners of the metal cut the hole in the gasket.



The simplest method of punching gasket holes is to place the blank gasket over the part which it is to fit and then place the ball peen hammer over the hole as shown and then tapping this hammer with another one.

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 747*)

sides, he imagines he will be able to hoodwink me."

"Do you think you can cure him? He looks like a pretty bad case."

"He *is* a hard case. In fact he is a resumé of the three classes of criminals: Those who receive their criminal instincts through inheritance, those who acquire them through evil training in their youth, and those who, through some physical cause that affects the brain, acquire a partial insanity or have their moral faculties warped."

"PEP" FEARS LOSING HER JOB

"Gee, doctor!" observed Pep, smiling, "If you cure all the criminals, you'll spoil my job as a reporter. Our newspapers would be pretty tame if everybody were good!"

"Not only the newspapers, Pep," replied Doctor Hackensaw, laughing, "but all our books, plays, and movies. What would a movie be without a villain? We owe more to the criminals than we are apt to imagine. The world would be somewhat monotonous without them. But I guess it will be some time before we get rid of the last of them."

"How do you set to the work of reform, doctor?"

"It all depends. If I can get hold of a baby I can do a great deal to eliminate undesirable inherited instincts. Oliver Wendell Holmes declared that early training would accomplish wonders, provided you began early enough. He added, however, that you might have to begin several thousand years before the baby was born. Personally, I believe that inherited instincts are of minor importance. Physical, mental, and moral inheritance can be controlled by proper means. Education is the important thing. Place the child of respectable parents in criminal surroundings, and he will almost certainly grow up a criminal. Take, on the other hand, the baby of criminal parents, give him into the custody of proper guardians, and he will become a virtuous man.

"The criminal is the product of poor education and poor conditions. Of course, physical defects play their part. Vicious cravings and appetites arise from morbid conditions. Disease of the brain may also lead to crime. To cure a criminal, you must first cure his body, including, of course, his brain. Then you must counteract his early vicious training."

"How can you do that?"

"Well, our knowledge of the brain is as yet at a rudimentary stage. Certain indications lead us to believe that each part of the brain has some definite function. Touch a certain portion of an animal's brain, and the animal will move its right leg. Touch another portion and it will move its right arm. The same thing seems to be true of the mental and moral faculties. Certain areas of the brain seem to be the seat of memory, others of the reasoning-power, others of the will-power. Of course, I am aware that these 'regional controls,' as they are called, are far from proved. In fact, modern experiments seem to show that if one portion of the brain is cut out, some other portion after a time is able to take up the functions of the portion removed. But normally we may assume that each area of the brain has some special function, and injury to that area will disturb the function.

REFORMATION BY OBLITERATING VICIOUS MEMORIES

"Taking this as my starting-point, I began my experiments. If, as I believe, it is a man's early training that is the principal cause of his going wrong, then if we could blot out that early training and start afresh, we ought to be able to make a new man of him. In a word, I became convinced that all criminals could be cured if we could erase from their minds the memories they had acquired during their early life, the bad habits they had formed, and all knowledge of their vicious companions.

"Of course all of us have memories we should wish to destroy—memories of things done or left undone, or of ridiculous situations in which we have been placed, or superstitions we have acquired in youth.

"Unfortunately I have not yet found means of destroying separate memories—the task is far beyond my powers. I am obliged to obliterate practically everything that is in the mind and start again from the very beginning. This I accomplish by means of my 'Memory Obliterator,' a device that enables me to make a fallen woman forget her old life and begin anew; and that makes a criminal forget his crimes and his associates and leaves him free to start afresh. I can even make a drunkard forget his craving for drink."

"How does your machine work?"

"You must know, Miss Pep, that memory is a most peculiar thing—in fact every part of the body seems to possess a memory of its own. What we call habit is a sort of memory of the body. Take for example the stenographer working the keys of her typewriter. Her fingers seem to know just what distance to go to strike a certain key. She could work blindfold. This is the result of practice. Every action often repeated becomes a habit, and these habits constitute a kind of memory. A very strange fact is the persistence of memory. If you learned how to skate or how to ride a bicycle twenty years ago, and have never practiced since, you will be surprised to find that you have not forgotten the trick. In all probability every particle that composes your body has changed in those twenty years, but the habit remains. To explain this we must assume that the new particles in some way inherit the memories or habits of the old ones. The brain, as you may perhaps know, contains millions of microscopic neurones connected irregularly with each other by filaments—My theory was that these connections between the neurones must explain the association of ideas which is the basis of memory, one idea calling up the other ideas associated with it by means of the connecting filaments. Working on this theory I made experiments on the effect of X-rays, radium emanations, and wireless waves on these filaments. I struck the right method and found means of destroying the associations between the neurones without injuring them. In this way I am able to destroy past memories and so leave a clean page for the formation of new ones. It is this method that I am about to apply to the reformation of Six-Fingered Pete."

As the doctor finished speaking, Inspector Fox entered the room.

READY FOR THE OPERATION

"Pete is all ready for the operation," said he.

Pep and the doctor entered the operating room, where the patient was stretched motionless under the powerful electrical machine that was to destroy his memories of a life of crime and make a new man of him. An anaesthetic had been administered and all was in readiness.

Doctor Hackensaw rapidly divested himself of his coat and carefully adjusted the micrometer screws that regulated his "Memory Obliterator."

(*Continued on page 794*)

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Dr. Hackensaw's Secrets

(*Continued from page* 792)

"Now then, Miss Pep," said he, "just turn that switch. In less than an hour Pete's mind will be a blank. He will have completely forgotten every incident of his past life, and will be ready to start afresh and become an honest man."

* * * * * * * * *

Three years had passed since the date on which Doctor Hackensaw had performed the marvelous operation on the brain of Six-Fingered Pete. The operation had been entirely successful. Pete had awakened none the worse physically, but his mind had become a complete blank. It was curious to watch him as he tried to rise from his bed. He was more helpless than a babe, for his muscles had lost all power of co-ordination. Walking was of course out of the question, for he had forgotten how to balance himself. He had forgotten how to talk, and he had even forgotten how to see. Like a new-born babe he was unconscious of what was going on around him. Everything had to be learned over again, just as a baby has to learn. He had this advantage, however, that his brain and his muscles were fully developed, and some vague remnants of memory remained. His progress was therefore extremely rapid. What it takes a child ten years to learn, Pete was able to master in a few months.

He was naturally bright and energetic, but his training was rendered difficult by the fact that he was a strong man instead of a helpless baby, and hence not so easy to control. Doctor Hackensaw was obliged to keep him in a padded room with six strong attendants continually on the alert. Otherwise he would have walked out of the window or into a fire just as a baby would have done. As new memories were formed, however, and he learned to take care of himself, he was allowed more liberty, and finally the day came when he could go about as he pleased. His cure seemed complete for he gave no evidence of any of the criminal traits which had formerly rendered him a menace to society. His pardon had been secured and Doctor Hackensaw kept him at his New Jersey cottage where he was employed on the farm.

Doctor Hackensaw, on his return from his trip to the moon, had kept his promise to Miss Pep Perkins. The proofs of her innocence were so complete that the warrant for her arrest was never served. She was a frequent visitor at the doctor's summer cottage, and one hot Sunday she started out for a stroll through the woods, and unfortunately chose a short cut though a pasture where some cattle were feeding. Pep was not aware of the fact that a vicious bull was pastured with the herd. And it happened that this bull, on that particular day, was wild from a tussle with a hornets' nest—an encounter in which the bull was not victorious. While smarting from the pain of his stings, what should the bull see but a young lady coming tripping through the pasture. It was a direct challenge. The bull lowered his head and came rushing at her with a threatening bellow.

Pep was no country girl, but she was a good sprinter and turned to run. But she could not have made good her escape had not a third actor appeared on the scene. This was Six-Fingered Pete, who had come to drive the cattle to the barn. He took in the situation at a glance, and rushed to head off the bull.

Now in Spanish bull-fights, the toreador seems to have an easy task dodging the excited beasts. But, in the arena the bull is first tired out by the picadors or men on horseback. Moreover the toreador has helpers to divert the attention of the bull, and there are aisles of safety as retreats. In a country pasture the thing is not so easy. Pete had no jacket to wave at the bull, but he did what was probably the best thing under the circumstances. He picked up a double handful of earth and threw it in the eyes of the infuriated animal just as the latter was on the point of goring Pep.

Half blinded, the bull swerved from his course, and Pep was saved, but the animal came straight for Pete and the poor man was thrown to the ground and gored unmercifully.

* * * * * * * * *

By the time the farm-hands, armed with pitch-forks, had rescued him, he was past all help.

The life that Doctor Hackensaw had saved was thus sacrificed before the results of the experiments with the "Memory Obliterator" could be fully realized. But to Doctor Hackensaw the proof was convincing that the reformation of criminals was a possibility if their minds could only be washed clean of all their criminal memories and a fresh start made.

Around the Universe

By RAY CUMMINGS

(*Continued from page* 749)

Sir Isaac, his blood running cold in his veins, shook himself together, and with deliberate care depressed two of the keys. The Heavens turned over swiftly, dizzily.

Tubby, who was standing in the center of the room, clutched Ameena for their mutual support.

"Don't look at them windows!" he cautioned. "Close your eyes. Perfessor, which way we goin'? What'll I do to help? Where's them Mercurians? Are we duckin' 'em?"

Nothing could be distinguished through the windows save the rapidly shifting firmament. Sir Isaac gritted his teeth.

"That tiny asteroid!" he muttered. "We were near it, the first asteroid in my calculation."

A blinding white glare burst through the side window; Sir Isaac, desperately pressing other keys, finally brought the Heavens to rest.

"It's—all right," he panted. "That burst of light—that—"

Through the side window a tiny blazing globe was receding above them; from none of the windows was the Mercurian vehicle to be seen.

THE ENEMY ANNIHILATED

"We are safe," said Sir Isaac a moment later, when they had all calmed down a little. "The Mercurians collided with that little asteroid. They are annihilated.

Sir Isaac's face was as sober as though this were personally a great misfortune to himself—which indeed it was. He added:

(*Continued on page* 796)

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Around the Universe

(*Continued from page 794*)

"That asteroid was the first in my calulation—the one on which I was to begin operations. This unforeseen collision has changed its course—the whole fabric of my calculations has been altered." Tears welled into his eyes. "I—I tried so hard to have it mathematically perfect. And now it's ruined! Now we are powerless to save our world!"

The unfortunate man was overcome for a moment. Tubby and the white faced girl sat beside him.

"You can figure it out again," Tubby said consolingly. "Try, perfessor. Maybe it ain't ruined at all."

Under the influence of Ameena's gentle fingers stroking his hair, and her soft words of courage in his ear, Sir Isaac suddenly braced up.

"I'll do it!" he cried. "Give me my pencil and paper . . . Ameena, make me some strong, black coffee. Bring it here . . . with my lunch . . . Tubby, give me my cigarettes, and let me alone. Go away. I must rectify this terrible error."

He dashed the damp locks of hair from his eyes; and while Ameena hurried into the kitchen, he lighted a cigarette, pushed Tubby away, and plunged feverishly into his ruined computation. Ten minutes later he was altering the vehicle's course and, with his array of delicate scientific instruments, was making careful observations of the asteroid's present direction and rate of flight.

Tubby kept out of the instrument room. At noon, Ameena took Sir Isaac's luncheon into him on a tray. He smiled up at her, momentarily suspending his flying pencil.

"I do hope your computation isn't ruined, dear Sir Isaac," she murmured gently.

"Oh no," he said. "In fact I am beginning to think quite the contrary." He seemed wholly cheerful. "The Mercurian vehicle colliding with my asteroid altered its course, naturally. But I am beginning to discover that the alteration is favorable to my plans rather than the reverse."

He patted her shoulder. "Thank you, Ameena . . . That stew looks delicious . . . I shall have my new calculation completed in an hour, I hope. That Mercurian collision was a blessing in disguise."

So it proved, for by two o'clock in the afternoon Sir Isaac called his friends into the instrument room and triumphantly displayed his new set of figures.

"Very good indeed," approved Tubby. "Let's get to usin' 'em. What do we do first?"

"At 3:57 P. M. this afternoon we shall approach that same asteroid," Sir Isaac announced. "Just leave everything to me. It is all quite simple now!"

COAXING AN ASTEROID FROM ITS COURSE

At 3:57 P. M. exactly they were encircling the asteroid at a distance of some ten miles—speeding around it in a circular orbit as though they were its satellite. But with each revolution they paused on one side and drew away slightly, coaxing it from its path by their attraction.

It was a tiny celestial wanderer indeed—not more than three or four thousand feet in diameter Sir Isaac said—nothing but a boulder flying alone through Space.

At 4:17 P. M. the vehicle withdrew. Tubby was anxious to have something happen; but for nearly an hour nothing did. It was 4:45 P. M. when Sir Isaac pointed through the side window to another, somewhat larger asteroid approaching. With careful work at the keyboard he swooped the vehicle toward it—around it twice—and then slowly away again in the opposite direction.

"There," he murmured. "I think I have done my part correctly. The laws of Celestial Mechanics must do the rest."

He sat at the side window, watching. Tubby and Ameena saw the first asteroid far above them. The other was obviously nearing it. Both had been deflected from their normal course by Sir Isaac's skill; a collision was inevitable.

THE ASTEROIDS COLLIDE

It came at 5:51 P. M.—as Sir Isaac had calculated—a soundless flash, and then a new, larger celestial body, the fused mass of the other two, wavering in Space, plunging diagonally toward the Sun, and at last finding its new orbit by that delicate balancing of forces which is the marvel of Celestial Mechanics.

Sir Isaac was jubilant. He took several observations of the new asteroid.

"Perfect, my dear friends The new orbit is identical with my calculation. There will be another collision, with a much larger planetoid, at 7:19 P. M. Let us have dinner."

"Very good idea," approved Tubby with relish.

Tubby and Ameena still had only a vague idea of how all this was to save the Earth; but they trusted Sir Isaac implicitly. Besides, they did not dare ask any advance details, which would have offended Sir Isaac's sense of the dramatic.

The second collision—another, larger flash—took place exactly at the appointed time. And all during the evening and far into the night, other collisions occurred. Each involved larger bodies—and after each, from the vehicle which followed in their train, Sir Isaac computed the orbital elements of the new celestial body.

"You had better go to sleep," he said, at two o'clock. "There will not be another until 4:35 A. M. It involves a very considerably larger body—I shall wake you up in time to see it."

He added solemnly:

"I trust this next Minor Planet is not inhabited. I do not think so, though it is over two hundred miles in diameter. I did not want to involve it—but I had to."

At 6:03 P. M. the following evening, just twelve minutes before the long-anticipated opposition of Mars with the Earth, the climax came. There had been two gigantic collisions during the day. The last one—at 2:23 P. M.—involved two bodies of almost equal mass which approached each other from diametrically opposite directions. A head-on crash ensued. A new body, fused into a molten mass by the created heat of arrested motion, hung for an instant suspended—completely devoid of orbital velocity. Then it moved downward—slowly at first, then swiftly, with constant acceleration plunging down toward the center of mass of the Solar System—the Sun.

The vehicle followed it cautiously. Watching this enormous, fiery derelict created by the mathematical genius of Sir Isaac, it was nearly six o'clock before Tubby and Ameena grasped the true significance of what was taking place before their very eyes.

The new asteroid—five hundred miles in diameter, a white-hot core with flames hundreds of miles in height leaping from it, plunged [illegible] But Mars also lay beneath [illegible] tly off to one side—Mars. [illegible] ldish, smug-looking crescent [illegible] firmament.

(*Page 798*)

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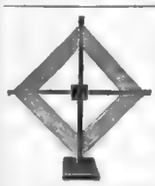

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D2600 Two foot loop aerial, complete..$1.15

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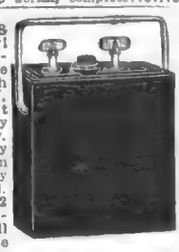

Two volt, 40 ampere hour storage battery for use with WD11, 12, and U.V. 199 tubes. Don't keep on buying dry cells continuously. This storage battery will pay for itself in two months. Only best materials used. Guaranteed for 2 years. You can connect up to 6 dry cell tubes on a single one of these batteries. Can be recharged for a few cents. Hard rubber container encased in impregnated wood case Due to low price and large weight of batteries, shipped express collect.

D2400 Two volt, 40 ampere hour storage battery, size 2¼x8x9" $3.90

D640 Six volt, 40 ampere hour storage battery, size 4¾x7¼x9" 7.25

D660 Six volt, 60 ampere hour storage battery, size 6x7x9¼" 9.50

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Highest grade mahogany cabinets made. Best hand rubbed finish. Top is hinged. Front of cabinet rabbetted to fit panel. Price delivered to your door; no panel included in these prices.

Entire cabinet made of ½" well seasoned stock.

D714 Wood cabinets, panel size 7x14" $3.35
D718 Wood cabinets, panel size 7x18" 3.60
D724 Wood cabinets, panel size 7x24" 4.40
D710 Wood cabinets, panel size 7x10" 2.60
D712 Wood cabinets, panel size 7x12" 3.00
D721 Wood cabinets, panel size 7x21" 3.90

"RASCO" BEZELS

The finest Bezel on the market. Best brass mesh used. The Bezel comes entirely nickle plated. Will improve looks of your panel 100 per cent. Outside diameter 1". Can be used on ⅛" or 3-16" panel.

D1700 Rasco bezel .....$.15
D1701 Bezel 1½" diam. .20

UNIVERSAL BEARING

THE bearing to hold variometer and variocoupler rotors. Total length of bearing 2¼". Outside shaft, 1⅜". Length of thread 1". Length of threaded sleeve, ¾".

D1375 Bearing .....$.25

COPPER FOIL

Thinnest copper foil made, .001" thick. Comes 4" wide.

D5025 Copper Foil per ft. $.10
10-ft. length ..... .80

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Clearance Sale.

This sheeting is positively the best grade on the market. High Finish on both sides. Too well known to require much explanation. Due to the fact that we are discontinuing these particular sizes, this material is now offered practically at cost. Prices are about 40 per cent lower than our catalogue list. Note also that we ship these panels prepaid.

D350 6"x12"x3-16" thick, each.....$1.50
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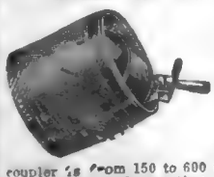
D353 12"x18"x3-16" thick, each 4.00
D354 6½"x19½"x3-16" thick, each.... 1.90
D356 6"x14"x3-16" thick, each 1.60
D357 6"x4"x3-16" thick, each ..... .65

RASCO 180° VARIOCOUPLER



This Coupler while extremely low in price will do anything and everything that the more expensive ones accomplish Silk Wire wound on bakelite tubes. There are six taps. Wave length of coupler is from 150 to 600 meters. Coupler is made for panel mounting, ¼" shaft. Your money refunded if it is not all we claim.

D3100 Variocoupler, prepaid $1.50

MELOTONE LOUD SPEAKER

The best popular loud speaker on the market. Has tuned feature the same as all "Rico" phones. Fibre horn, heavy metal base, five foot cord. Nickle goose neck. Greatest tuned talker. Compares favorably with most expensive speakers. Size overall 14½"; horn length 11½"; bell 6⅝"; total height 9".

D255 Melotone Speaker $4.90

RICO TUNED RECEIVERS

No better phones made. Supersensitive. Awarded Radio News Laboratories Certificate of Merit. The only tuned phone on the market. Can be tuned for any intensity and sensitivity. Magnetic pole of phone is in mathematical center of diaphragm.

D666 2000 ohms, double head set not adjustable $3.50

D2020 2000 ohms, double head set TUNED..$4.45

D3030 3000 ohms, double head set TUNED..$5.50

TO TUNE: TIGHTEN or LOOSEN CAP SLIGHTLY

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Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Does away with vernier condenser. We guarantee results. All metal parts moulded in best black composition. Nothing to come apart. Biggest bit of the season.

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D650 Post made entirely of best black composition—8-32" screw—each $0.08

D202 Post has nickel-plated bottom part, each ..... .08

Dozen, each style ..... .90

650 202

JUST OUT

AUTOPLEX CIRCUIT

The famous Autoplex circuit described in RADIO NEWS has taken the country by storm. The only single tube outfit that works a loud-talker. Results guaranteed.

1-D714 Mahogany Cabinet, 7x14" $3.35
1-D7140 Dilectrite Panel, 7x14"..... 1.20
2-D5353 Moulded Variometers..... 6.00
2-D3076 1" Dials ..... .80
1-D5014 1250 turn Honeycomb coil.... 1.95
1-D6500 Vacuum Tube Socket..... .35
1-D4310 6 ohm Rheostat ..... .45
8-D201 "Rasco" Binding Posts..... .80
8-Assorted Binding Post Name Plates .18
5-D6400 Feet Bus Bar Wire..... .25
1-D5209 Consolidated Autoplex pattern .50
Total $15.83

Our special price, complete.....**$15.25**

Complete with Melotone Loud-speaker **$20.00**

"RASCO" SOCKETTES

Substitute for Vacuum Tube Socket. Four of these take one Vacuum Tube. Grasp tube firmly. Best contact possible. Take less room. Are better.

D1550 Sockettes, nickeled, set of 4 .....$.25

D1551 Sockettes, nickeled, set of 4 (to take WD-11 Tube).... .25

Note: Set of 4 sufficient to hold 1 tube.

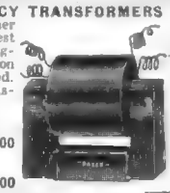
PHONEHORN

Fills a new and distinct want. Base consists of D1310 Phonadapter described on this page into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver and you have the lowest priced loud talker ever made. Mounted in your set or hung in corner of room it will bring sound all over the room. A most useful article. Welcome by all radio fans.

D1321 Phonehorn, prepaid.....$1.45

AUDIO FREQUENCY TRANSFORMERS

No better Transformer on the market. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.



D1100 A.F. Transformer, ratio 4½ to 1 .....$2.00

D1150 A.F. Transformer, ratio 6½ to 1 .....$2.00

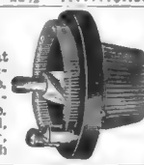
RADIO FREQUENCY TRANSFORMERS

The best Radio Frequency Transformer developed so far. Designed for us by Mr. R. E. Lacault, Associate Editor of RADIO NEWS. Air core. Guaranteed to do the work. This Transformer brings in the long distances.

D2800 Radio Frequency Transformer, size 1⅞"x2½" $1.50

RHEOSTATS AND POTENTIOMETERS

Highest grade Rheostat made. High heat dielectric composition base. Wound with best non-corrosive resistance wire. Comes with tapered, knurled knob. Diameter, 2½". Complete with pointer.



D4310 6 ohm, each $.45
D4311 30 ohms, for 301a and 201a tubes, each 65
D4312 Potentiometer, 200 Ohms, each.... .85

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SPIDER WEB FORMS

At last! Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. 3200 has 13 slots, 3201, 11 slots, both 5" diameter. 3201 has projection for mounting.

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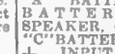
D3200 Spider web form, each .....$.25

D3201 Spider web form, each .....$.25

3201

BRASS RODS



Sold in 6" lengths only.

D6032 Brass Rod 8/32" thread, per length .....$.06

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The circular plate is our new Binding Post Name Plate. Diameter, ¾". These denominations: PHONES, GROUND, —, OUTPUT, "A" BATTERY —, "B" BATTERY —, LOUD SPEAKER, GRID, LOAD, "C" BATTERY —, AERIAL, +, INPUT, "A" BATTERY +, "B" BATT +, LOOP, TICKLER, PLATE, "C" BATT +, FILAMENT

D6000 to 6019 Binding Post Name Plates, each denomination .....$.03

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REINARTZ DUO-SPIDERWEB COIL

Here is a very fine inductance for Reinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Can be used in nearly all new circuits. Construction: duo-spider-web throughout. Coil is firm and will not fall apart as is case with many inferior makes. A few of these coils will work wonders in your set

D2650 Spider-web Reinartz coil $1.15

PHONODAPTER

The Phonodapter will fit any phono. Metal tube fits any standard phonograph. Make your phonograph a loud talker. Fits Columbia, Victor and Sonora phonographs. Is made entirely of pure soft rubber with brass tube insert.

D1310 Phonodapter .....$.40

DOUBLE PHONODAPTER

The Double Phonodapter fits all phonographs and will take any standard double head set, thereby making your phonograph a loud talker. Made of cast metal, nickel plated and highly polished. Has three generous soft rubber bushings.

D1320 Double Phonodapter..... .65

PLUGS

RASCO Telephone Plug. This is the plug that is sold from 75c. to $1.00 everywhere. Has hard rubber composition shell and patented cord tip holder. Must be seen to be appreciated. Finest workmanship throughout.

D1030 Rasco Telephone Plug, each.....$.35

LITZ WIRE

D823 equals No. 25 B&S, per foot .....$.02

D890 equals No. 28 B&S, per foot ..... .01

D891 equals No. 21 B&S, per foot ..... .03

D892 equals No. 20 B&S per foot ..... .04

Discounts of 10 percent in 100 foot lots.

PANEL MOUNTING VARIABLE CONDENSERS

This condenser presents the latest word in precision mechanics. Plates, washers, and all other parts are accurately machined. Positively no better condenser on the market. Shafts ⅛". Save from 40% to 60% by assembling condenser yourself. A child can do it in a few minutes' spare time. Capacity guaranteed.

D1111 11 plate condenser, .00025 mfd. $1.10
D2121 21 plate condenser, .0005 mfd. 1.22
D4343 43 plate condenser, .001 mfd. 1.50

The "Rasco" Catalog No. 10

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We have a plan whereby you can. We can give you a complete but simplified high school course in two years, giving you all the essentials that form the foundation of practical business. It will prepare you to hold your own where competition is keen and exacting. Do not doubt your ability, but make up your mind to it and you will soon have the requirements that will bring you success and big money. YOU CAN DO IT.

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Name.....

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Around the Universe

(*Continued from page* 796)

BLAZING ASTEROID PLUNGES TOWARD MARS

Minutes passed. The three watchers crouched tense at the lower window of the instrument room. The blazing asteroid plunged on. Its course for the Sun would take it half a million miles to the side of Mars! Five minutes more! The asteroid, feeling Mars' attraction as it approached, began turning gradually aside, deflected by this other attraction which at such proximity was greater than the Sun's.

Then at last Tubby understood! He gripped Ameena—breathless.

"Look! Mars is pullin' it! Look!"

It was 6:03 P. M. exactly when, with a gigantic, soundless flash, the molten asteroid collided squarely with the Planet's upper surface!

CHAPTER XII

IN WHICH TUBBY'S WONDERFUL GIFT, REVIVED ON EARTH, BRINGS ABOUT A CATACLYSM, AND HIS ASTRONOMICAL ADVENTURES ARE ABRUPTLY TERMINATED.

WHAT a triumph, even for the genius of a super-mathematician! A blazing, molten mass of matter five hundred miles in diameter had fallen upon the surface of Mars at almost the very moment of its anticipated triumph over an inoffensive neighboring planet! No wonder Tubby and Ameena were overjoyed! No wonder Sir Isaac's pale, intellectual countenance could not but reflect the pride in his heart!

Tubby shook his friend's hand warmly; Ameena kissed him.

"Well," declared Tubby, "I guess that settles them Martians. Some excitement for them right now!"

"Did it kill many of them, do you think, Sir Isaac?" Ameena asked anxiously. "Women and little children—"

"I'm afraid it did," Sir Isaac said soberly. "I could not help that—the innocent must everywhere suffer for the guilty. I had to do the best I could for our own world."

He sat down, pondering. Then he added: "I have no idea what such a collision would do or what may be the result of it to the orbit of Mars and thus to the other planets. The heat generated may have roasted every living creature on the globe. Or perhaps not. But I rather imagine those armies will have enough to do at home without undertaking an invasion of the Earth for some time to come."

"I should guess yes," Tubby declared enthusiastically. He threw his arms around Ameena and kissed her vigorously. "Now all we got to do is hurry right home so you an' me can get married. Ain't I right, kid?"

The girl agreed that this was logical.

"I shall have you there tomorrow," said Sir Isaac. "We need not bother with the Moon—let us leave that little Martian army marooned there. We will let it alone—it cannot harm us."

"Sure," agreed Tubby. "Let it alone. Come on, let's eat an' then play poker."

On this last leg of the journey, Sir Isaac insisted on going slowly. In the first place he was thoroughly exhausted and demanded twelve solid hours' sleep; and also, with Tubby and Ameena thus in continuous command, he felt it was advisable to make haste slowly. It was therefore not until 9:45 P. M. the following evening that the vehicle landed again upon the Earth from which it had departed some sixty days previously.

THE LAST EVENING ABOARD

The last evening in the vehicle was a solemn one. Tubby and Ameena were to part from their friend and take their honeymoon trip alone in it to Venus. A hazardous voyage, doubtless! But youth and inexperience are always confident.

"You're a very wonderful man, Sir Isaac," Ameena said during that last supper.

"You sure are," Tubby confirmed. He hesitated, scratching his head. "But say, perfessor, there's one or two things about this here voyage of ours I ain't quite got clear."

Sir Isaac nodded encouragingly.

"For one thing," Tubby began, "I ain't got this gravity part very straight. Why is it when we're in this vehicle don't we personally feel all these here changes of gravity? If the gravity is cut off from under us why don't we get lighter?"

It was a stupendous bit of logical reasoning on Tubby's part. It surprised Ameena; it amazed Sir Isaac.

"Why—why—" he stammered. Then he smiled frankly

"I really cannot explain exactly," he confessed. "The thing surprised me very much. I've been worrying over it for my manuscript. It is a fact that we do not feel any changes of gravity until we actually land upon some celestial body. But why, I cannot say. I think it's because of our velocity, the constant acceleration or changes of velocity of the vehicle. Motion and gravity are very closely related. If it's that, Einstein would know all about it. He disagrees with me on almost everything, but still he's a nice sort of chap. I think I shall have to consult him."

"I would," said Tubby. "Then there's another thing. You got this here vehicle built wrong. You got the observatory on top an' we're always goin' the other way. You never onc't used that little telescope. An' then there's—"

"Tubby!" cautioned Ameena. And, in deference to the feelings of their friend, who after all was only human and therefore liable to err, Tubby took the hint and stopped.

THE SKY-TRAVELERS ON EARTH AGAIN

They landed, after a careful reconnoiter, within a few hundred feet of where they had started. As they stepped from the vehicle to that earth upon which Ameena had never before set foot, Bill Hawkins' apple trees were in plain sight in the moonlight. Instantly Tubby remembered his wonderful gift which had brought Sir Isaac's Inter-planetary vehicle into material being. The thought of it had never crossed his mind since the first few minutes after their departure from Earth. How foolish all their perturbation over the Martian attack! Why all they need have done was come home, and Tubby could have wished that all the Martians and Mercurians would drop dead as fast as they landed!

Tubby explained all this excitedly to his friends. Sir Isaac frowned.

"I thought of that," he said. "But I could not be concerned in trickery like that. My public would not stand for it. We had a scientific problem to solve, and we solved it with science—quite reasonably and properly."

Tubby nodded acquiescence; but his eyes were sparkling as he regarded Bill Hawkins' apple orchard.

(*Continued on page* 800)

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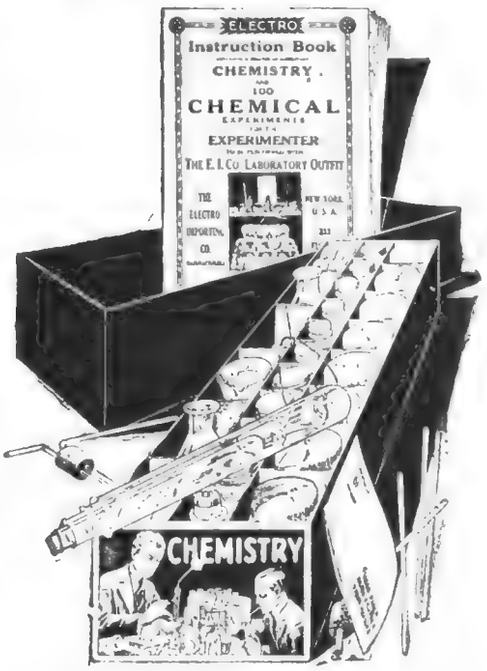
A Chemistry Laboratory for $7.00

Think of it, fellows! Here is a *real* chemistry outfit with regular chemical apparatus that performs those fascinating, actual chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry.



DESCRIPTION OF THE OUTFIT

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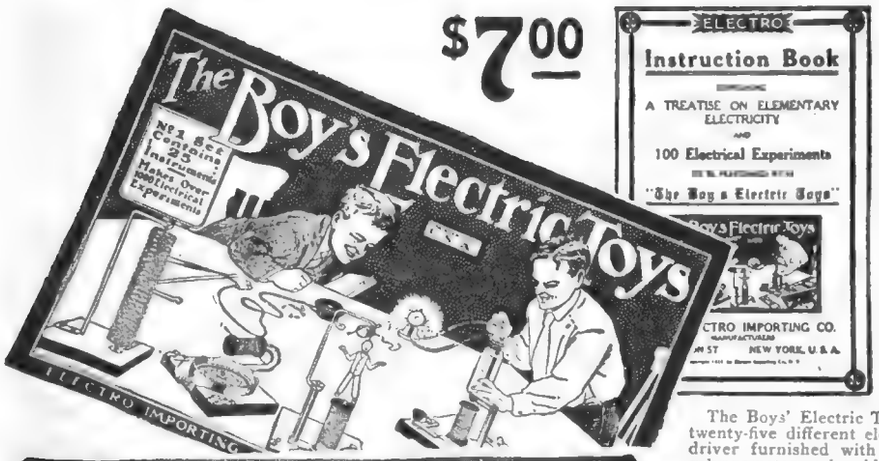

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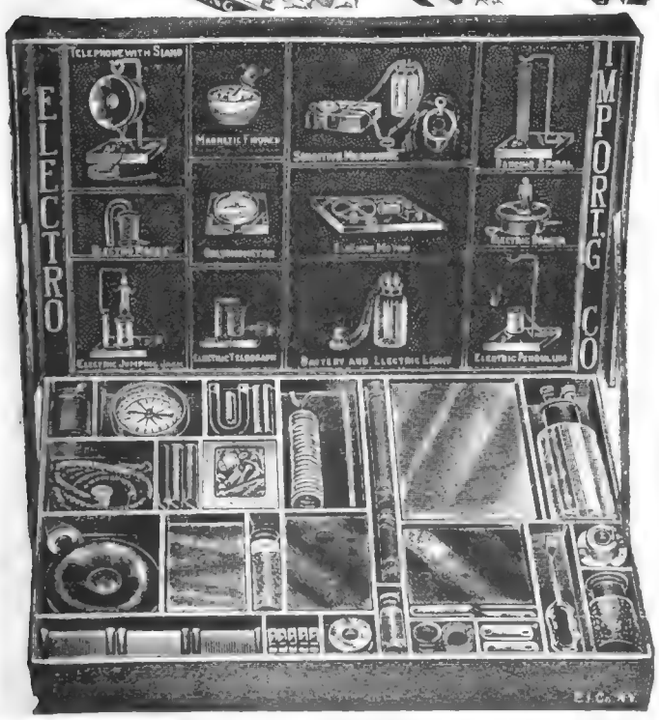

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Around the Universe

(*Continued from page* 798)

"All right, perfessor. But *I'm* goin' to get revenge on this guy Hawkins anyway. You do things your way—I do them my way. Come on over an' let's see them apples turn rotten."

Sir Isaac was greatly annoyed. "I beg you not to. It is childish. To engage in such foolishness, after all our scientific adventures—"

"*You* did that onc't," Tubby suddenly accused. "An' when you wrote how you did it, you signed that there Wells name. *I* read it."

Sir Isaac flushed. "Yes, I did," he admitted with some heat. "I did descend once to such an unplausable trick—and I've been sorry for it ever since. I've been trying to live it down. I—Tubby, you'll only bring disaster upon yourself—upon all of us. Forget that ability you have. Don't ever—"

"I ain't goin' to forget it," Tubby persisted doggedly. "I wish all Bill Hawkins' apples was rottin' on the trees. I wish—"

A diabolical memory of that similar situation Sir Isaac had once conceived under his favorite "Herbert George" name came to Tubby.

TUBBY'S WISHING POWER GETS HIM INTO TROUBLE.

"I *wish* the Earth was revolvin' twice as fast as usual, so Bill Hawkins' house would fly off in the air," he intoned.

Ameena flung her arms about his neck; Sir Isaac gave a cry of terror. A fearful gale of wind came roaring down upon them. Stones, sticks, every manner of flying missile, whistled by.

Sir Isaac, shouting something incoherent, flung himself prone upon the ground. Tubby gripped a tree-trunk to hold himself from blowing away; Ameena clutched him in terror.

In the midst of the hurricane Bill Hawkins' house was standing firm. Sudden madness possessed Tubby.

"I *wish* the Earth was revolvin' ten times as fast! I *wish*—"

Sir Isaac's body left the ground, hurtling into the air like a bullet. Tubby grasped one arm around Ameena, and one about the tree-trunk. He felt like a balloon tugging at its leash. The wind was a cyclone. A house went sailing off through the air—Bill Hawkins' house.

"Tubby! Don't Tubby!"

The girl's appealing cry frightened Tubby. A flying billet of wood struck him viciously on the shoulder. He tried desperately to think of something to stop this horrible cataclysm.

"I *wish*—" he murmured. "I *wish* I hadn't never been able to wish nothin'. I *wish* I'd forget all about havin' done this. I *wish*—"

The clink of the poker chips was incessant—annoying. Tubby stared across the smoke laden room at the three men under the circle of light. He remembered dimly that they had been arguing, and sat up abruptly.

"As I was sayin', Jake," he announced. "I got a idea that this here Edge of Space—"

. . . THE END.

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KDYL	Telegram Publishing Co.,	Salt Lake City, Utah	50—360
KDYM	Savoy Theatre,	San Diego, Calif.	50—252
KDYQ	Oregon Institute of Technology,	Portland, Oregon	5—360
KDYS	The Tribune,	Great Falls, Montana.	50—360
KDYW	Smith Hughes Machinery Co.,	Phoenix, Ariz.	20—360
KDYX	Star Bulletin,	Honolulu, Hawaii	100—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZE	The Rhodes Co., (Dept. Store),	Seattle, Wash.	100—455
KDZF	Automobile Club of Southern Calif.,	Los Angeles, Calif.	500—278
KDZI	Electric Supply Co.,	Wenatchee, Wash.	50—360
KDZK	Nevada Machinery & Electric Co.,	Reno, Nevada	25—360
KDZQ	Nichols Academy of Dancing, (Hal G. Nichols),	Denver, Colo.	10—360
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KFAE	State College of Washington,	Pullman, Wash.	500—360
KFAF	Western Radio Corporation,	Denver, Colo.	500—360
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAP	Standard Publishing Co.,	Butte, Mont.	100—360
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KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
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KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—238
KFCD	Salem Electric Co., (F. S. Barton),	Salem, Oreg.	20—360
KFCF	Frank A. Moore,	Walla Walla, Wash.	50—360
KFCH	Electric Service Station, Inc.,	Billings, Mont.	10—360
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.	10—242
KFCL	Los Angeles Union Stock Yards,	San Antonio, Calif.	500—360
KFCM	Richmond Radio Shop, (Frank T. Doeing),	Richmond, Calif.	100—360
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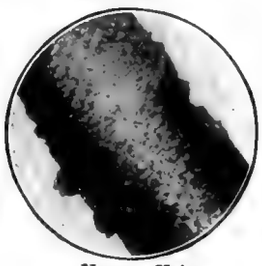

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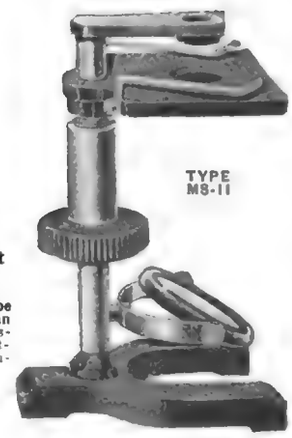

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KFEQ	J. L. Scroggin,	Oak, Nebr.	150—360
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	20—231
KFEV	Radio Electric Shop,	Douglas, Wyo.	100—263
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho.	10—360
KFEZ	Amer. Society of Mechanical Engineers, (F. H. Schubert),	St. Louis, Mo.	100—360
KFFA	Dr. R. O. Shelton,	San Diego, Calif.	50—242
KFFB	Jenkins Furniture Co.,	Boise, Idaho.	10—240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—360
KFFP	First Baptist Church,	Moberly, Mo.	100—275
KFFQ	Marksheffel Motor Co.,	Colorado Springs, Colo.	100—360
KFFO	Dr. E. H. Smith,	Hillsboro, Oreg.	5—229
KFFR	Nevada State Journal (Jim Kirk),	Sparks, Nev.	10—226
KFFV	Graceland College,	Lamoni, Iowa	100—360
KFFX	McGraw Co.,	Omaha, Nebr.	250—278
KFFY	Pincus & Murphey,	Alexandria, La.	100—275
KFFZ	Al G. Barnes Amusement Co.,	Dallas, Tex. (portable)	20—226
KFGC	Louisiana State University,	Baton Rouge, La.	100—254
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	20—248
KFGH	Leland Stanford University, (P. O.)	Stanford Univ., Calif.	500—360
KFGJ	Missouri National Guard, 138th Infantry,	St. Louis, Mo.	250—266
KFGL	Arlington Garage,	Arlington, Oreg.	5—234
KFGP	Cheney Radio Co.,	Cheney, Kans.	10—229
KFGQ	Crary Hardware Co.,	Boone, Iowa	20—226
KFGV	Heidbreder Radio Supply Co.,	Utica, Nebr.	10—224
KFGX	First Presbyterian Church,	Orange, Tex.	500—250
KFGY	Gjelhangs Radio Shop,	Bandette, Minn.	20—224
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	10—268
KFHA	Colorado State Normal School,	Gunnison, Colo.	50—360
KFHB	Rialto Theatre, (P. L. Beardwell),	Hood River, Oreg.	5—280
KFHD	Utz Electric Shop Co.,	St. Joseph, Mo.	20—226
KFHF	Central Christian Church,	Shreveport, La.	150—266
KFHH	Ambrose A. McCue,	Neah Bay, Wash.	50—253
KFHI	Charles V. Dixon,	Wichita, Kans.	20—224
KFHJ	Fallon & Co.,	Santa Barbara, Calif.	100—360
KFHQ	Curtis Bros. Hardware Store (Alfred E. Fowler),	Los Gatos, Calif.	5—242
KFHR	Star Electric & Radio Co.,	Seattle, Wash.	100—270
KFHS	Clifford J. Dow,	Lihue, Hawaii	30—275
KFHU	M. G. Sateren,	Mayville, N. Dak.	50—261
KFHX	Robert W. Nelson,	Hutchinson, Kans.	50—229
KFHY	R. S. McEwan,	Trinidad, Colo.	50—242
KFI	Earle C. Anthony, Inc.,	Los Angeles, Calif.	500—469
KFIB	Franklin W. Jenkins,	St. Louis, Mo.	10—244
KFID	Ross Arbuckle's Garage,	Iola, Kans.	20—246
KFIF	Benson Polytechnic Institute,	Portland, Oreg.	100—360
KFIK	Gladbrook Electrical Co.,	Gladbrook, Iowa	20—234
KFIL	Windesch Electric Farm Equipment Co.,	Louisburg, Kans.	30—234
KFIO	North Central High School,	Spokane, Wash.	50—252
KFIQ	Yakima Valley Radio Broadcasting Association,	Yakima, Wash.	50—224
KFIU	Alaska Elec. Light & Power Co.,	Juneau, Alaska	10—226
KFIV	Y. H. Broyles,	Pittsburg, Kans.	20—240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.		500—240
KFIY	Brott Laboratories,	Seattle, Wash.	15—236
KFIZ	Daily Commonwealth and Oscar A. Huelsman,	Fond du Lac, Wis.	100—273
KFJA	Central Power Co.,	Grand Island, Nebr.	100—244
KFJB	Marshall Electrical Co.,	Marshalltown, Iowa	10—248
KFJC	Seattle Post Intelligencer,	Seattle, Wash.	100—233
KFJD	Weld County Printing & Publishing Co.,	Greeley, Colo.	50—236
KFJF	National Radio Mfg., Co.,	Oklahoma City, Okla.	20—252
KFJH	The Sugar Bowl, (H. R. Shaw),	Selma, Okla.	10—273
KFJI	Liberty Theatre, (E. E. Marsh),	Astoria, Oreg.	10—252
KFJJ	Carrollton Radio Shop,	Carrollton, Mo.	50—236

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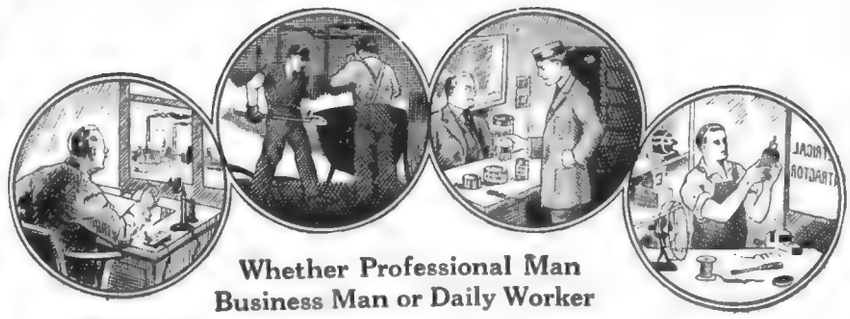

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Call Letters	Name	Location	Power & Wave Length
KFJK	Delano Radio & Electric Co.,	Bristow, Okla.	100—233
KFJL	Hardsacg Mfg., Co.,	Ottumwa, Iowa.	10—242
KFJM	University of North Dakota,	Grand Forks, N. Dak.	100—229
KFJQ	Electric Construction Co., Valley Radio Division,	Grand Forks, N. Dak. (portable)	5—252
KFJR	Ashley C. Dixon & Son,	Stevensville, Mont. (near)	50—258
KFJV	Thomas H. Warren,	Dexter, Iowa	10—224
KFJW	Le Grand Radio Co.,	Towanda, Kans.	10—226
KFJX	Iowa State Teachers College,	Cedar Falls, Iowa	50—229
KFJY	Tunwall Radio Co.,	Fort Dodge, Iowa	50—246
KFJZ	Texas National Guard Cavalry, 112th	Fort Worth, Texas	20—254
KFKA	Colorado State Teachers College,	Greeley, Colo.	50—248
KFKB	Brinkley-Jones Hospital Association,	Milford, Kans.	500—286
KFKH	Denver Park & Amusement Co.,	Lakeside, Colo.	10—226
KFLE	National Education Service,	Denver, Colo.	10—268
KFKX	Westinghouse Electric & Mfg., Co.,	Hastings, Nebr.	500—286
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Oreg.	50—360
KGN	Northwestern Radio Mfg. Co.,	Portland, Oreg.	100—360
KGU	Marion A. Mulrony,	Honolulu, Hawaii	250—360
KGW	Portland Morning Oregonian,	Portland, Oregon	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHQ	Louis Wasmer,	Seattle, Wash.	100—360
KJFU	Central Power Co.,	Kearney, Nebr.	10—234
KJQ	C. O. Gould,	Stockton, Calif.	5—360
KJR	Northwest Radio Service,	Seattle, Wash.	100—270
KJS	Bible Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLN	Monterey Electric Shop,	Monterey, Calif.	10—261
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—360
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—360
KMJ	San Joaquin Lt. & Power Corp'n.,	Fresno, Calif.	250—360
KMO	Love Electric Co.,	Tacoma, Wash.	10—360
KNJ	Roswell Public Service Co.,	Roswell, N. Mex.	500—250
KNT	Grays Harbor Radio Co., (Walter Hemrich),	Aberdeen, Wash.	250—263
KNV	Radio Supply Co.,	Los Angeles, Calif.	100—256
KNX	Electric Lighting Supply Co.,	Los Angeles, Calif.	100—360
KOB	New Mexico College of Agriculture and Mechanic Arts, State College,	N. Mexico	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Calif.	500—423
KQI	University of California,	Berkeley, Calif.	500—360
KQP	Apple City Radio Club,	Hood River, Oreg.	10—360
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Penn.	500—360
KQW	Chas. D. Herrold,	San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—278
KSD	Post Dispatch, (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KSS	Prest & Dean Radio Co. & Radio Research Society of Long Beach,	Long Beach, Calif.	20—360
KTW	First Presbyterian Church,	Seattle, Wash.	500—360
KUO	Examiner Printing Co.,	San Francisco, Calif.	150—360
KUS	City Dye Works & Laundry Co.,	Los Angeles, Calif.	100—360
KUY	Coast Radio Co.,	El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co.,	Stockton, Calif.	100—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	500—360
KXD	Modesto Herald Publishing Co.,	Modesto, Calif.	10—252
KYQ	Electric Shop,	Honolulu, Hawaii	20—360
KYW	Westinghouse Electric & Mfg., Co.,	Chicago, Ill.	500—345
KZM	Preston D. Allen,	Oakland, Calif.	50—360
KZN	The Deseret News,	Salt Lake City, Utah	500—360
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.	50—360
WAAB	Valdemar Jensen,	New Orleans, La.	100—268
WAAC	Tulane University,	New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal,	Chicago, Ill.	200—286
WAAH	Commonwealth Electric Co.,	St. Paul, Minn.	100—360
WAAK	Gimbel Bros.,	Milwaukee, Wis.	100—280
WAAM	I. R. Nelson Co.,	Newark, N. J.	250—263
WAAN	University of Missouri,	Columbia, Mo.	50—254
WAAP	United Electric Co.,	Wichita, Kans.	150—360
WAAW	Omaha Grain Exchange,	Omaha, Nebr.	200—360
WAAZ	The Hollister-Miller Motor Co.,	Emporia, Kans.	100—360
WABB	Dr. John B. Lawrence,	Harrisburg, Pa.	10—266
WABC	Fulwider-Grimes Battery Co.,	Anderson, Ind.	10—229
WABD	Parker High School,	Dayton, Ohio	10—283
WABE	Young Man's Christian Association,	Washington, D. C.	250—234
WABF	Mount Vernon Register-News Co.,	Mount Vernon, Ill.	100—234
WABG	Arnold Edwards Piano Co.,	Jacksonville, Fla.	10—248
WABH	Lake Shore Tire Co.,	Sandusky, Ohio.	100—240
WABI	Bangor Railway & Electric Co.,	Bangor, Me.	50—240
WABJ	The Radio Laboratories,	South Bend, Ind.	10—240
WABK	First Baptist Church,	Worcester, Mass.	10—252
WABL	Connecticut Agricultural College,	Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co.,	Saginaw, Mich.	100—254
WABN	Waldo C. Grover,	LaCrosse, Wis.	250—244
WABO	Lake Ave., Baptist Church,	Rochester, N. Y.	20—252
WBAA	Purdue University,	West Lafayette, Ind.	250—360
WBAD	Sterling Electric Co.,	Minneapolis, Minn.	100—360
WBAF	Fred M. Middleton,	Moorestown, N. J.	100—360
WBAH	The Dayton Co.,	Minneapolis, Minn.	500—360
WBAN	Wireless Phone Corporation,	Paterson, N. J.	100—244
WBAO	James Millikin University,	Decatur, Ill.	50—360
WBAP	Wortham-Carter Publishing Co., (Star-Telegram),	Fort Worth, Tex.	500—476
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	500—390
WBAW	Marietta College,	Marietta, Ohio	250—246
WBAX	John H. Stenger, Jr.,	Wilkes-Barre, Pa.	20—360
WBAY	Western Electric Co.,	New York, N. Y.	500—492
WBBA	Newark Radio Laboratories,	Newark, Ohio	20—240
WBBC	Sterling Radio Equipment Co.,	Sterling, Ill.	50—229
WBBD	Barbey Battery Service,	Reading, Pa.	50—234
WBL	T & H Radio Company,	Anthony, Kansas	100—261
WBS	D. W. May (Inc.),	Newark, N. J.	20—360
WBT	Southern Radio Corp.,	Charlotte, N. C.	50—360
WBU	City of Chicago,	Chicago, Ill.	500—286
WBZ	Westinghouse Electric & Mfg., Co.,	Springfield, Mass.	250—337
WCAD	St. Lawrence University,	Canton, Ohio	250—280
WCAE	Kaufman & Baer Co.,	Pittsburgh, Pa.	500—462
WCAG	Clyde R. Randall,	New Orleans, La.	50—268
WCAH	Entrekin Electric Co.,	Columbus, Ohio	100—286
WCAJ	Nebraska Wesleyan University,	University Place, Nebr.	500—360
WCAK	Alfred P. Daniel, Asst. Division Mgr.,	A.R.R.L., Houston, Texas	50—360
WCAL	St. Olaf College,	Northfield, Minn.	250—360
WCAM	Villanova College,	Villanova, Pa.	150—360
WCAO	The Sanders and Stayman Co.,	Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D. C.	500—469
WCAR	Alamo Radio Electric Co.,	San Antonio, Texas	150—360
WCAS	Wm. Hood Dunwoody Industrial Institute,	Minneapolis, Minn.	100—246
WCAT	South Dakota State School of Mines,	Rapid City, S. Dak.	50—240
WCAU	Durham & Co.,	Philadelphia, Pa.	250—286
WCAV	J. C. Dice Electric Co.,	Little Rock, Ark.	20—360
WCAX	University of Vermont,	Burlington, Vt.	50—360
WCAY	Kesselman O. Driscoll Co.,	Milwaukee, Wis.	250—261
WCAZ	Carthage College,	Carthage, Ill.	50—246
WCBA	Charles W. Humbach,	Allentown, Pa.	5—280
WCBB	K & K Radio Supply Co., (Charles H. Katzenberger),	Greenville, Ohio.	100—240
WCBD	Wilbur G. Voliva,	Zion, Ill.	500—345
WCE	Findley Electric Co.,	Minneapolis, Minn.	250—360
WCK	Stix Baer & Fuller Dry Goods Co.,	St. Louis, Mo.	100—360
WCM	University of Texas,	Austin, Texas	500—360
WCX	The Detroit Free Press,	Detroit, Mich.	500—517
WDAD	Central Kansas Radio Supply Co., (Wm. L. Harrison),	Lindsborg, Kans.	10—360
WDAE	Tampa Daily Times,	Tampa, Fla.	250—360
WDAF	Kansas City Star,	Kansas City, Mo.	500—411
WDAG	J. Laurance Martin,	Amarillo, Texas.	100—263
WDAH	Trinity Methodist Church (South),	El Paso, Texas.	100—268
WDAI	Hughes Radio Corp.,	Syracuse, N. Y.	100—246
WDAK	The Courant,	Hartford, Conn.	100—261
WDAL	Florida Times-Union,	Jacksonville, Fla.	100—360
WDAO	Automotive Electric Co.,	Dallas, Texas	50—360
WDAP	Board of Trade,	Chicago, Ill.	500—360
WDAR	Lit Bros.,	Philadelphia, Pa.	500—395
WDAS	Samuel A. Waite,	Worcester, Mass.	5—360
WDAU	Slocum & Kilburn,	New Bedford, Mass.	100—360
WDAX	First National Bank (Appamoose County Farm Bureau),	Centerville, Iowa	100—360
WDAY	Fargo Radio Electric Co.,	Fargo, N. Dak.	50—244

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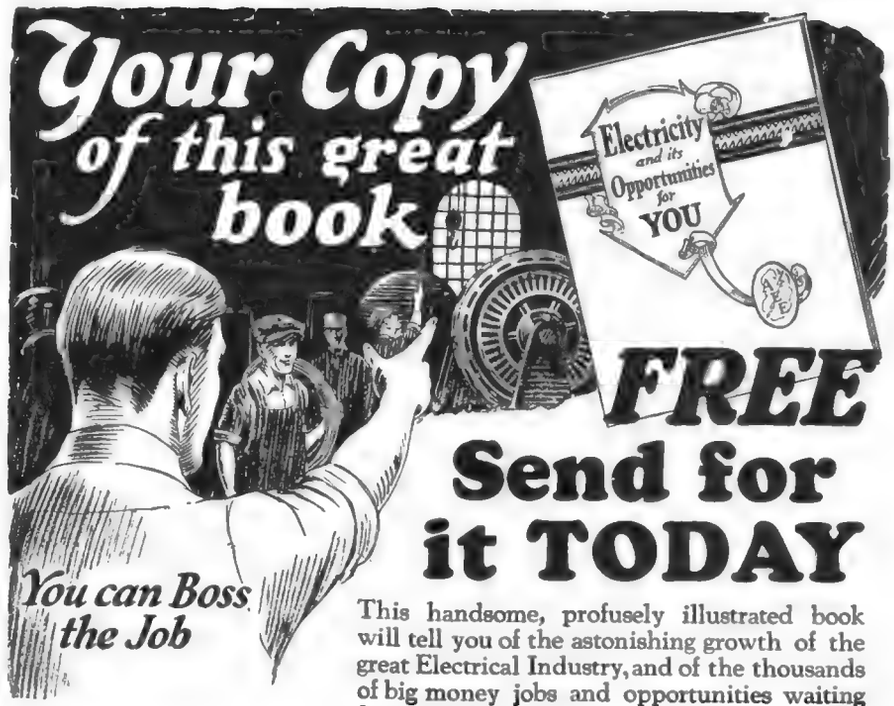
Call Letters	Name	Location	Power & Wave Length
WDBC	Kirk Johnson & Co.,	Lancaster, Pa.	50—258
WDBF	Robert G. Phillips,	Youngstown, Ohio	50—261
WDM	Church of the Covenant,	Washington, D. C.	50—360
WDT	Ship Owners' Radio Service,	New York, N. Y.	500—405
WDZ	J. L. Bush,	Tuscola, Ill.	10—278
WEAA	Frank D. Fallain Police Building,	Flint, Mich.	150—280
WEAB	Standard Radio Equipment Co.,	Fort Dodge, Iowa	500—360
WEAF	American Telephone & Telegraph Co.,	New York, N. Y.	500—492
WEAG	Nichols-Hineline-Bassett Laboratory,	Edgewood, R. I.	10—231
WEAH	Wichita Board of Trade & Lander Radio Co.,	Wichita, Kansas	100—244
WEAI	Cornell University,	Ithaca, N. Y.	500—286
WEAJ	University of South Dakota,	Vermillion, S. Dak.	200—360
WEAK	Julius B. Abercrombie,	St. Joseph, Mo.	15—360
WEAM	Borough of North Plainfield, (W. Gibson Buttfield),	North Plainfield, N. J.	100—252
WEAN	Shepard Co.,	Providence, R. I.	100—273
WEAO	The Ohio State University,	Columbus, Ohio	500—360
WEAP	Mobile Radio Co.,	Mobile, Ala.	100—360
WEAR	Baltimore American News Publishing Co.,	Baltimore, Md.	50—360
WEAS	Hecht Co.,	Washington, D. C.	50—360
WEAU	Davidson Bros., Company,	Sioux City, Iowa	100—360
WEAY	Will Horwitz, Jr.,	Houston, Texas	250—360
WEB	Benwood Co.,	St. Louis, Mo.	500—360
WEV	Hurlburt-Still Electrical Co.,	Houston, Texas	250—360
WEW	St. Louis University,	St. Louis, Mo.	100—261
WFAA	The Dallas News, The Dallas Journal,	Dallas, Texas	500—476
WFAB	Carl F. Woese,	Syracuse, N. Y.	200—234
WFAF	H. C. Spratley Radio Co.,	Poughkeepsie, N. Y.	20—360
WFAH	Electric Supply Co.,	Port Arthur, Texas	150—360
WFAJ	Hi-Grade Wireless Instrument Co.,	Ashville, N. C.	50—360
WFAM	Times Publishing Co.,	St. Cloud, Minn.	20—360
WFAN	Hutchinson Electric Service Co.,	Hutchinson, Minn.	100—360
WFAQ	Missouri Wesleyan College,	Cameron, Mo.	10—360
WFAT	The Daily Argus-Leader,	Sioux Falls, S. Dak.	100—360
WFAV	University of Nebraska, Dept. E. E.,	Lincoln, Nebr.	100—360
WFI	Strawbridge & Clothier,	Philadelphia, Pa.	500—395
WGAL	Lancaster Elec. Supply & Const. Co.,	Lancaster, Pa.	10—248
WGAN	Cecil E. Lloyd,	Pensacola, Fla.	50—360
WGAQ	Glenwood Radio Corp., (W. G. Patterson),	Shreveport, La.	100—360
WGAR	Southwest American,	Fort Smith, Ark.	20—360
WGAU	Radio Mfg. & Service Co., (Marcus G. Limb),	Wooster, Ohio	20—226
WGAW	Ernest C. Albright,	Altoona, Pa.	100—261
WGAY	North Western Radio Co.,	Madison, Wis.	100—360
WGAZ	The South Bend Tribune,	South Bend, Ind.	100—360
WGF	The Register & Tribune,	Des Moines, Iowa	100—360
WGI	American Radio & Research Corp.,	Medford Hillside, Mass.	500—360
WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGR	Federal Telephone and Telegraph Co.,	Buffalo, N. Y.	500—360
WGV	Interstate Electric Co.,	New Orleans, La.	100—360
WGY	General Electric Co.,	Schenectady, N. Y.	1000—380
WHA	University of Wisconsin,	Madison, Wis.	500—360
WHAA	State University of Iowa,	Iowa City, Iowa	100—283
WHAB	Clark W. Thompson,	Galveston, Texas	200—360
WHAC	Cole Bros. Electric Co.,	Waterloo, Iowa	10—360
WHAD	Marquette University,	Milwaukee, Wis.	100—280
WHAG	University of Cincinnati,	Cincinnati, Ohio	200—222
WHAH	Hafer Supply Co.,	Joplin, Mo.	250—360
WHAI	Radio Equipment & Mfg. Co.,	Davenport, Iowa	50—360
WHAK	Roberts Hdwe., Co.,	Clarksburg, W. Va.	15—258
WHAL	Lansing Capital News,	Lansing, Mich.	20—360
WHAM	University of Rochester, (Eastman School of Music),	Rochester, N. Y.	100—360
WHAO	Frederic A. Hill,	Savannah, Georgia	100—360
WHAP	Otta & Kuhns,	Decatur, Ill.	50—360
WHAQ	Semmes Motor Co.,	Washington, D. C.	10—360
WHAR	Paramount Radio & Electric Co., (W. H. A. Paulus),	Atlantic City, N. J.	15—231
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAV	Wilmington Electrical Specialty Co., Inc.,	Wilmington, Del.	50—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380



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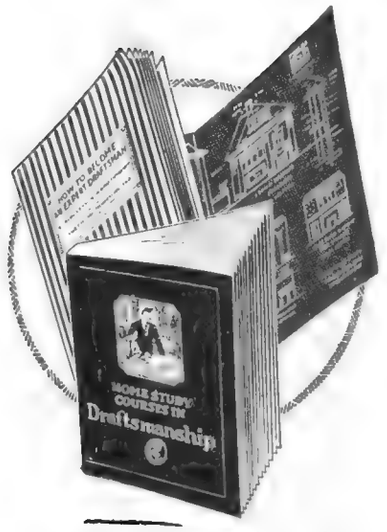

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Call Letters	Name	Location	Power & Wave Length
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHD	West Virginia University,	Morgantown, W. Va.	250—360
WHK	Radiovox Co., (Warren R. Cox),	Cleveland, Ohio	500—360
WHN	George Schubel,	New York, N. Y.	100—360
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas.	100—360
WIAD	Ocean City Yacht Club, (Howard R. Miller),	Ocean City, N. J.	10—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAH	Continental Radio & Mfg., Co.,	Newton, Iowa	10—360
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox-River-Valley Radio Co.,	Nunah, Wis.	100—224
WIAK	Journal-Stockman Co.,	Omaha, Nebr.	200—278
WIAO	School of Engineering of Milwaukee,	Milwaukee, Wis.	200—360
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	100—226
WIAR	Paducah Evening Sun,	Paducah, Ky.	100—360
WIAS	Home Electric Co.,	Burlington, Iowa.	100—360
WIAT	Leon T. Noel,	Tarkio, Mo.	15—360
WIAU	American Trust & Savings Bank,	Le Mars, Iowa	20—360
WIAY	Woodward & Lothrop,	Washington, D. C.	100—360
WIK	K & L Electric Co.,	McKeesport, Pa.	500—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	5—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAB	American Electric Co.,	Lincoln, Neb.	500—360
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAF	Press Publishing Co.,	Muncie, Ind.	10—360
WJAG	The Norfolk Daily News,	Norfolk, Nebraska	200—360
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa.	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kansas	100—360
WJAR	The Outlet Co., (J. Samuels & Bro.),	Providence, R. I.	50—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Penna.	500—360
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	1000—273
WJD	Howe, Richard H.,	Granville, Ohio	50—229
WJH	Wm. P. Boyer Co.,	Washington, D. C.	50—273
WJX	De Forest Radio Telephone & Telegraph Co.,	New York, N. Y.	500—360
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa.	100—268
WKAD	Charles Looff, (Crescent Park),	East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	200—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	100—280
WKAS	L. E. Lines Music Co.,	Springfield, Mo.	10—360
WKAV	Laconia Radio Club,	Laconia, N. H.	50—360
WKAW	Turner Cycle Co.,	Beloit, Wis.	10—242
WKAX	William A. MacFarlane,	Bridgeport, Conn.	15—231
WKAY	Brenau College,	Gainesville, Ga.	20—360
WKC	Joseph M. Zamoiski Co.,	Baltimore, Md.	20—360
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	100—360
WLAC	North Carolina State College,	Raleigh, N. C.	750—360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	250—234
WLAJ	Waco Electrical Supply Co.,	Waco, Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	500—360
WLAL	Naylor Electrical Co., (Sim Naylor),	Tulsa, Okla.	100—360
WLAN	Putnam Hardware Co.,	Houlton, Me.	250—283
WLAP	W. V. Jordon,	Louisville, Ky.	15—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—360
WLAT	Radio & Specialty Co.,	Burlington, Iowa	10—360
WLAV	Electric Shop,	Pensacola, Fla.	20—360
WLAW	Police Dept.,	New York, New York, N. Y.	500—360
WLAX	Putnam Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	100—360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma, Okla.	100—360
WMAC	J. Edw. Page (Clive B. Meredith),	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254

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Call Letters	Name	Location	Power & Wave Length
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	15—256
WMAM	Beaumont Radio Equipment Co.,	Beaumont, Texas	100—360
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAP	Utility Battery Service,	Easton, Penna.	50—246
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Georgia	50—268
WMC	Commercial,	Memphis, Tenn.	500—500
WMH	The Precision Equipment Co.,	Cincinnati, Ohio	10—248
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	100—261
WNAC	Shepard Stores,	Boston, Mass.	100—360
WNAD	University of Oklahoma,	Norman, Okla.	100—360
WNAL	R. J. Rockwell,	Omaha, Nebraska	20—242
WNAM	Ideal Apparatus Co.,	Evansville, Ind.	500—360
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	100—286
WNAP	Wittenberg College,	Springfield, Ohio.	100—360
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	20—360
WNAR	C. C. Rhodes,	Butler, Mo.	20—231
WNAS	Texas Radio Corp. & Austin Statesman,	Austin, Texas	100—360
WNAT	Lennig Bros. Co., (Fred'k Lenning),	Philadelphia, Penna.	250—360
WNAV	People Telephone & Telegraph Co.,	Knoxville, Tenn.	500—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, South Dak.	100—244
WNAW	Peninsular Radio Club,	Fort Monroe, Va.	5—360
WNJ	The Shotton Radio Mfg., Co., Inc.,	Albany, New York	55—360
WOAA	Dr. Walter Hardy,	Ardmore, Okla.	100—360
WOAB	Valley Radio,	Grand Forks, N. Dak.	5—441
WOAC	Maus Radio Co.,	Lima, Ohio	100—266
WOAD	Friday Battery & Elec., Co.,	Sigourney, Iowa	10—360
WOAE	Midland College,	Fremont, Neb.	20—360
WOAF	Tyler Commercial College,	Tyler, Texas	100—360
WOAG	Apollo Theatre (Belvidere Amusement Co.),	Belvidere, Ill.	100—224
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	100—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAJ	Ervins Electrical Co.,	Parsons, Kansas	15—258
WOAK	Collins Hdwe., Co.,	Frankfort, Ky.	20—240
WOAL	Wm. E. Woods,	Webster Groves, Mo.	500- 229
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	150—360
WOAO	Lyradion Mfg., Co.,	Mishawaka, Ind.	50—360
WOAP	Kalamazoo College,	Kalamazoo, Mich.	50—375
WOAQ	Portsmouth Kiwanis Club,	Portsmouth, Va.	15—360
WOAR	Henry P. Sundskow,	Kenosha, Wis.	50—360
WOAT	Boyd M. Hamp,	Wilmington, Del.	50—360
WOAV	2nd Battalion, 112th Inf. P. N. G.,	Erie, Penna.	100—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff, (Monument Pottery Co.),	Trenton, N. J.	100—240
WOAZ	Penick Hughes Co.,	Stamford, Texas.	100—360
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	100—360
WOK	Pine Bluff Co.,	Pine Bluff, Ark.	500—360
WOO	John Wanamaker,	Philadelphia, Penna.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Penna.	500—360
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	200—360
WPAD	W. A. Wieboldt & Co.,	Chicago, Ill.	500—360
WPAF	Peterson Radio Co.,	Council Bluffs, Iowa	10—360
WPAH	Wisconsin Dept. of Markets,	Waupaca, Wis.	250—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	10—268
WPAK	North Dakota Agricultural College,	Agricultural College, N. Dak.	250—360
WPAL	Superior Radio & Tel. Equipment Co.,	Columbus, Ohio	100—286
WPAM	Auerbach & Guettel,	Topeka, Kansas.	100—360
WPAP	Theodore D. Phillips,	Winchester, Ky.	35—360
WPAQ	General Sales & Engineering Co.,	Frostburg, Md.	10—360
WPAR	Ward Battery & Radio Co.,	Beloit, Kansas	10—360
WPAT	St. Patricks Cathedral,	El Paso, Texas	20—360
WPAU	Concordia College,	Moorhead, Minn.	20—360
WPAZ	John R. Koch, Dr.,	Charleston, W. Va.	20—273
WPG	Nushawg Poultry Farm,	New Lebanon, Ohio	50—234

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WQAA	Horace A. Beale, Jr.,	Parkesburg, Penna.	500—360
WQAB	Southwest Missouri State Teachers College,	Springfield, Mo.	10—236
WQAC	E. B. Gish,	Amarillo, Texas	100—360
WQAD	Whitall Electric Co.,	Waterbury, Conn.	50—242
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio.	5—240
WQAH	Brock-Amerson Electrical Eng., Co.,	Lexington, Ky.	10—254
WQAK	Appel Higby Electric Co.,	Dubuque, Iowa	50—360
WQAL	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—360
WQAN	Scranton Times,	Scranton, Penna.	250—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co.,	Abilene, Texas	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAV	Huntington & Guerry (Inc.),	Greenville, S. C.	15—258
WQAW	Catholic University,	Washington, D. C.	5—236
WQAX	Radio Equipment Co.,	Peoria, Ill.	10—360
WQAZ	Greensboro Daily News,	Greensboro, N. C.	30—360
WRAA	Rice Institute,	Houston, Texas	200—360
WRAD	Taylor Radio Shop,	Marion, Kansas	10—248
WRAF	The Radio Club (Inc.),	Laporte, Ind.	10—224
WRAH	Stanley N. Read,	Providence, R. I.	10—231
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	20—229
WRAO	Radio Service Co.,	St. Louis, Mo.	100—360
WRAP	Winter Park Electrical Construction Co.,	Winter Park, Fla.	20—360
WRAR	Jacob C. Thomas,	David City, Nebraska	20—226
WRAS	Radio Supply Co.,	McLeansboro, Ill.	10—360
WRAU	Amarillo Daily News,	Amarillo, Texas	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—360
WRAX	Flaxon's Garage,	Gloucester City, N. J.	100—268
WRAW	Avenue Radio Shop,	Reading, Penna.	10—238
WRAY	Radio Sales Corp.,	Scranton, Penna.	50—280
WRAZ	Radio Shop of Newark, (Herman Lubinsky),	Newark, N. J.	50—233
WRC	Radio Corp., of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	20—360
WRW	Tarrytown Radio Research Laboratory, (Koenig Bros.),	Tarrytown, N. Y.	500—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence, R. I.	50—261
WSAG	City of St. Petersburg, (Loren V. Davis),	St. Petersburg, Fla.	10—244
WSAH	A. J. Leonard, Jr.,	Chicago, Ill.	500—248
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Penna.	100—360
WSAK	Foster Egner, (Daily News Pomeroy, O.),	Middleport, Ohio	70—258
WSAL	Franklin Electric Co.,	Brookville, Ind.	10—246
WSAN	Allentown Radio Club,	Allentown, Penna.	10—229
WSAP	Seventh Day Adventist Church,	New York, N. Y.	250—360
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	10—254
WSAT	Plainview Elec. Co.,	Plainview, Texas	20—268
WSAU	Camp Marienfeld,	Chesham, N. H.	10—229
WSAW	Curtice & McElwee,	Canandaigua, N. Y.	100—275
WSAX	Chicago Radio Lab.,	Chicago, Ill.	20—268
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSL	J. & M. Electric Co.,	Utica, N. Y.	100—273
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	10—248
WTAC	Penn. Traffic Co.,	Johnstown, Penna.	150—360
WTAD	Robert E. Compton, (First Presbyterian Church),	Carthage, Ill.	50—229
WTAF	Louis J. Gallo,	New Orleans, La.	20—242
WTAG	Kern Music Co.,	Providence, R. I.	10—258
WTAH	Carmen Ferro,	Belvidere, Ill.	10—236
WTAJ	The Radio Shop,	Portland, Me.	50—236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10—252
WTAM	Willard Storage Battery Co.,	Cleveland, Ohio	1000—390
WTAN	Orndorff Radio Shop,	Mattoon, Ill.	100—240
WTAP	Cambridge Radio & Elec., Co.,	Cambridge, Ill.	50—242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100—226
WTAR	Reliance Elec., Co.,	Norfolk, Va.	70—226
WTAS	Charles E. Erbstein	Elgin, Ill., (near)	500—279
WTAT	Edison Electric Illuminating Co.,	Boston, Mass., (Portable)	100—244

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WTAW	Agricultural & Mechanical College,	College Station, Texas	50—254
WTG	Kansas State Agricultural College,	Manhattan, Kansas	1000—485
WWAC	Sanger Bros.,	Waco, Texas	50—360
WWAD	Wright & Wright, Inc.,	Philadelphia, Penna.	50—360
WWAX	Wormser Bros.,	Loredo, Texas	50—360
WWB	Daily News Printing Co.,	Canton, Ohio	100—268
WWI	Ford Motor Co.,	Dearborn, Mich.	50—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517
WWL	Loyola University,	New Orleans, La.	100—280
WWZ	John Wanamaker,	New York, N. Y.	100—360

The Heavens in December

BY ISABEL M. LEWIS, M.A.

(*Continued from page 760*)

equal period regains its former brightness, is one of the most interesting variable stars in the heavens. Its peculiar light variations are due to periodic eclipses of the brighter star by a close faint companion of nearly equal size, as the two stars revolve around their common center of gravity.

Algol with the few faint stars near it form the Head of Medusa which Perseus carries in his hand as he comes to the rescue of Andromeda, daughter of Cassiopeia and Cepheus, who has been chained to the rocks to be devoured by the sea-monster, Cetus.

Andromeda and Pegasus are conspicuously in view in the western heavens. Gamma Andromeda, the most easterly of the three second-magnitude stars nearly in a straight line that are the characteristic feature of this constellation, is now very nearly in the zenith in 40° North latitude. Alpha Andromedae, which is the farthest west of the three stars, marks the northeast corner of the Great Square in Pegasus.

At this time of year when "The Pointers" of the Big Dipper, which point to the pole star are so close to the northern horizon that they are generally hidden from view behind trees or buildings, we turn to the stars of Andromedae and Cassiopeia to direct us to the Pole star, Cassiopeia lies almost exactly midway between Andromeda and the north pole.

A line drawn from Alpha Andromedae, the star in the northeast corner of the Great Square, through Beta Cassiopeiae, the star farthest west in Cassiopeia, and prolonged an equal distance will bring us to Polaris. We can also find the Pole-star by drawing a similar line from Gamma Andromedae, the star farthest east in Andromeda, through the star farthest east in Cassiopeia, which is also the faintest of the five stars that outline the W of Cassiopeia.

Early risers this month will find Mars well up in the eastern sky at sunrise.

Saturn is also in the eastern heavens now and the two planets will be in conjunction on the second of the month, and close to the first magnitude star Spica in Virgo. Saturn will remain in the constellation of Virgo near Spica throughout the month but since Mars, as well as the sun, is moving eastward, Saturn will be higher in the eastern heavens than Mars by the end of the month.

Venus, after being in the eastern sky from the beginning of the year to the tenth of September, may now be found in the western sky at sunset where it will remain for some months to come. It can be readily distinguished by its brilliancy which far surpasses that of any other planet or star in the heavens.

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Edited by Joseph H. Kraus

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SPARE TIRE AND RADIATOR LIGHT

(751) R. I. Black, Orcutt, Calif., asks our advice on a spare tire and a lighting suggestion for the radiator.

A. We would not solicit a patent upon either of your ideas. The spare tire device which you have designed is entirely too expensive and cannot be placed upon the market.

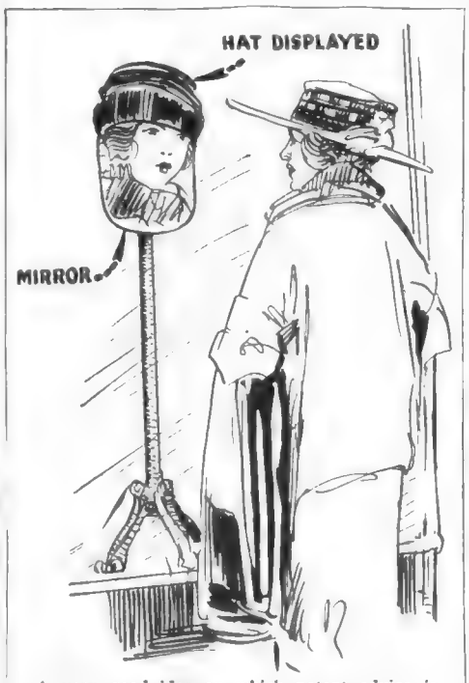
The lighting suggestion is relatively poor, a far better means being to attach a small bulb to the back of the bumper, and direct its light beam upon the radiator.

WINDOW DISPLAY STAND

(752) L. Z. Plebank, Chicago, Ill., requests our advice on a window display stand made as shown so that passers-by can see how a certain article of wearing apparel would appear on them.

A. We believe that your suggestion for a window hat display stand is unique, and if you can manage to force this upon the market, which should be relatively easy to do, we are of the opinion that the device would make a very fine saleable article.

We would suggest that you have a patent search made, and if the attorney claims that your device can be patented, that you proceed with an application for such patent, with the avowed intention of placing this device in the hands of various milliners. Provision should be made, if possible, to cover mirror attachment for the ordinary stands now found in millinery stores.

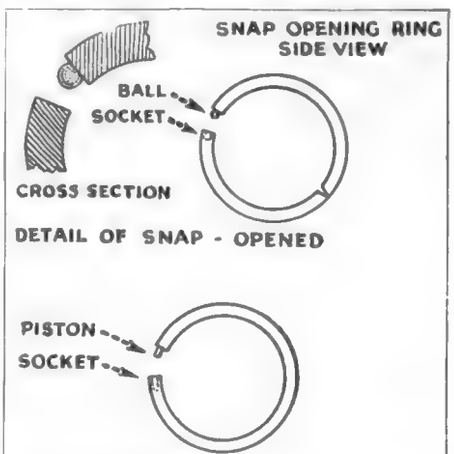


A very good idea on which patent advice is asked is shown in the above sketch. A mirror is placed on millinery stands on which a hat is mounted. It is of such shape that people passing on the street may see how they would look in the hat displayed.

SEPARABLE FINGER RING

(753) A. Kurzawski, Gilroy, California, says that sometimes a ring placed upon a finger cannot be removed—for that reason he has designed a ring which can always be taken from the finger even if the finger should swell or grow heavier. He points out its similarity to a bracelet.

A. We are quite confident that the finger ring which you have designed has considerable merit but, like a bracelet, it may open when least expected. Usually, a ring receives more wear and tear than a bracelet. Consequently such a jointed ring as you show is subject to loss sooner than a bracelet.

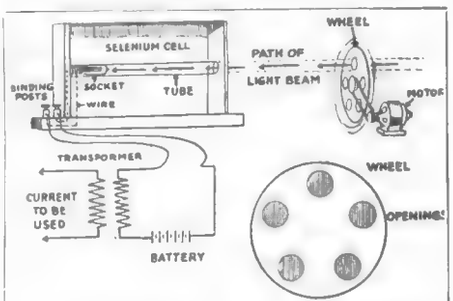


A ring that could be removed from the finger like a bracelet is not so good an idea, since the ring would be easily lost.

CURRENT INTERRUPTER

(754) Isaac Margolis, New York City, has submitted the idea for interrupting current for a spark coil or transformer shown herewith.

A. Your suggestion of an intermittent beam of light falling upon a selenium cell to produce an interrupted current for spark coil or transformer use, is absolutely worthless, in that a selenium cell will not conduct enough current in order to do this, its resistance being excessive.



The resistance of selenium is too high to make its use advisable in a heavy current interrupter.

(CONTINUED ON PAGE 812)

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CLARENCE A. O'BRIEN

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TWINE REEL

(755) N. J. LeGrande, Jr., New Ramburg, Mo., has designed a twine reel which will hold twine taken from packages, unknotted and wound upon the drum. He desires our opinion of its marketability.

As shown above, the idea here is a spool for waste twine. The idea is thought impracticable since the housewife has little repacking to do and therefore would have little use for such an arrangement.

A. Although the device designed by you would be of a slight benefit in the ordinary household, you must remember that the twine, which is received from packages, comes in varying sizes, in varying qualities, and different thicknesses. Consequently, if the housewife tied the pieces of twine together as she removes them from the packages, and wound them up on one of these spools, when the twine is to be used again, she may desire a rather thin piece and have to unwind a whole lot of heavy material, and vice versa. The employment of three or four of these spools, so that various sizes of twines could be wound upon them, will not overcome this difficulty. For the rather heavy twine, a large sized spool would have to be used. For thinner material, a small sized spool could be employed. Still, the device does not, in this ammended form, change its general features.

A canvas of women in your neighborhood will show, that they stand fifty to one against the use of your proposed device. This canvas should be carried out in the following manner. A model of the device, or half a dozen models should be built, and loaned to various individuals, or given to them. Six months later, or, even three months later, the inventor could go to these houses and inquire whether or not the device was being employed.

SHOE BOX HANDLE

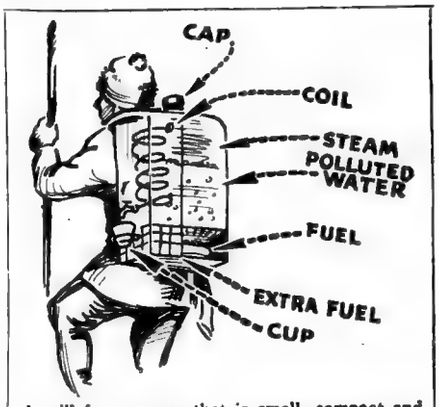
(756) S. S. Kahn, Ardmore, Cal., desires to put a handle on shoe boxes (containing shoes ready to deliver) in shoe stores so that all a person would have to do is to order his shoes, pay for them and walk out with them.

A. The editor is of the opinion that your device would not meet a long-felt want. On the contrary the handle of the shoe box will be practically worthless. We do not believe that there is a person in the United States today who purchases his shoes without trying them on, which necessitates the handling of the shoes and also boxes. Even though the shoe may conform to all measurements and sizes, it may not fit or may not appear well in the eyes of the wearer and that is the reason why we like to see the new shoes which we intend to purchase on our feet before we buy the same. We do not advise applying for patent upon this idea.

PORTABLE WATER STILL

(757) William B. Minuse, East Setauket, L. I., asks our opinion on a water still for campers made as shown and supplied with fuel bricks.

A. The water still which you have designed is a rather novel application of the still principle, and if handled correctly, could undoubtedly command a sale. We wish to state that a patent upon such a device will not be of any great value if the patent is to be sold, but manufacturing the device and placing it on the market yourself would undoubtedly attract attention.



A still for campers that is small, compact and light in weight is offered here for patent advice. The idea is good, since the still operates with compact fuel in the form of bricks. It is considered a fair proposition for manufacture but a patent search is advised.

If you find yourself financially able to manufacture or have these stills manufactured, and if you can place the same upon the market at prices commensurate with other stills, we believe you will have a fairly good paying proposition.

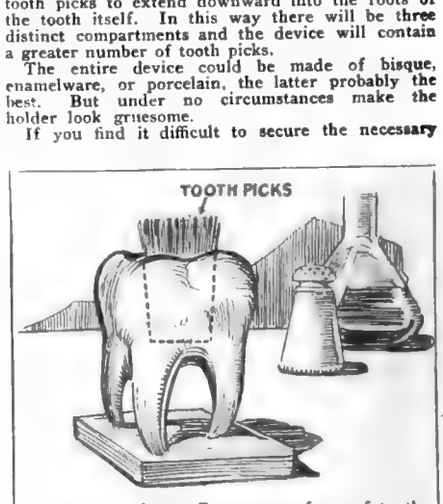
TOOTH PICK HOLDER

(758) William E. King, Monessen, Pa., asks for our opinion of a tooth pick holder made as shown.

A. We believe that your tooth pick holder as a novelty, would probably find a fair sale. In our opinion, it would be better to make the device a trifle smaller, and permit three receptacles for the tooth picks to extend downward into the roots of the tooth itself. In this way there will be three distinct compartments and the device will contain a greater number of tooth picks.

The entire device could be made of bisque, enamelware, or porcelain, the latter probably the best. But under no circumstances make the holder look gruesome.

If you find it difficult to secure the necessary financial aid to help in manufacturing this device, we would suggest that you put a few hundred dollars into the manufacture of these devices, or have them manufactured and then attempt to sell the same.



An inventor here offers a new form of toothpick holder. It is also advised that this is a good idea for manufacture and if manufactured by the inventor might be sold with ease. The container might be made from enamel or porcelain. The design should not be gruesome.

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Scientific Questions on Page 768 Answered.

By ERNEST K. CHAPIN.

THE answers to all the questions are arrived at through the laws of physics and mathematics. The problems are comparatively simple when they are studied, although the final answer is, in many cases, just the opposite of the first conclusion drawn as to the results of the tests.

THE BICYCLE PROBLEM

THE bicycle will move forward in the direction of the pull without skidding. This is explained by the fact that although the pedal is turning backwards (with reference to the axis of the sprocket) when the bicycle is going forwards the pedal is at every instant progressing over the ground.

TRAVELING NORTHWEST

A MAN could not travel northwest indefinitely but would circle closer and closer to the pole, until finally he reached it.

THE ROLLING SPOOL

IT is natural to jump to the conclusion that the spool will roll down hill unwinding the thread as it goes. On the contrary it will remain stationary as long as the thread is held fixed. For if the spool unrolled to the extent, say, of one revolution it would travel down the incline a distance equal to the circumference of the rim on which it rolls, but in the same time the thread would unwind by an amount only equal to the circumference of the drum—which is obviously impossible.

Still more surprising, perhaps, is the effect of pulling on the thread. In this case the spool actually rolls uphill winding up the thread as it goes. To understand this consider the relation of the forces represented in the diagram. The spool may be thought of as a lever with its pivot at the point of contact with the table. Let AC represent the force applied to the thread and OD the weight of the spool. Then OE is the component of OD down the plane of the table. The moment tending to roll the spool up the table is equal to AC x AB. The moment tending to roll the spool in the opposite direction is OE x OB. If these two moments are equal the spool remains stationary. But if AB x AC exceeds OE x OB the spool must move upward.

ALTITUDE AND GAS PRESSURE

THE pressure of street or illuminating gas at a house on top of a hill would be slightly less than the pressure at the bottom. Gas, like water and everything else material, has weight and hence the pressure at the top would be less than the pressure at the bottom. Ordinarily this would mean a trifling difference which would not be noticed.

CIGARETTE LOCUS

REMEMBERING that the pedal never goes back with reference to the ground, we get a series of curves from the lighted cigarette such as shown at the bottom of the illustration.

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THE MUSICAL ECHO

A SINGLE clap of the hands sends out practically a single pulse of sound through the air. Since the pickets are progressing farther and farther from the source the sound reaches them in succession and is in succession reflected to the ear. The train of sound pulses thus reaching the observer is then heard as a musical note whose pitch depends principally upon the spacing of the pickets.

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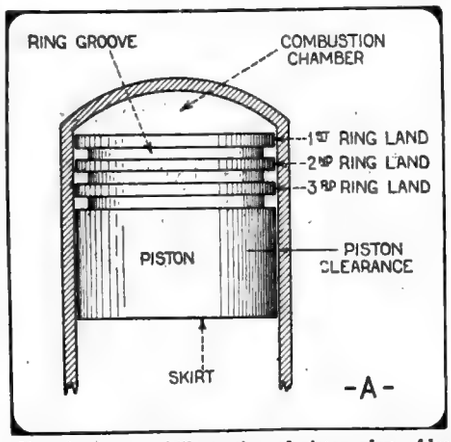
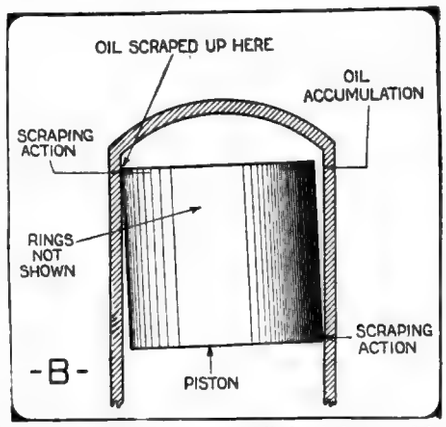
Motor Hints

Oil Pumping—Causes and Cures

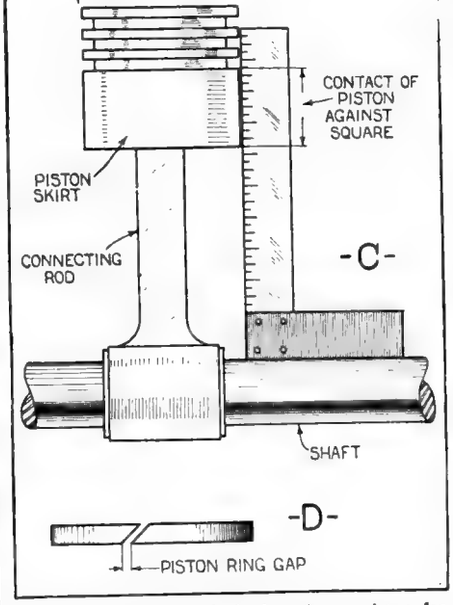
By TOM C. PLUMRIDGE



Here is shown an illustration of piston play. Also the sketch shows the correct names of the parts of a piston. All measurements should be made with micrometers.



When a piston cocks in a cylinder it is caused by a warped or strained connecting rod. Such a piston pumps much oil as well as scores the cylinder wall.



Above is shown a method of testing a piston for alignment. The connecting rod is bolted to a mandrel and the piston tested with a square as shown above. Both skirt and top of the piston should touch the square. To test the wear of a piston ring, place it in the cylinder and measure the gap. A gap should never be more than .002 to .003 inch for each inch of piston diameter.

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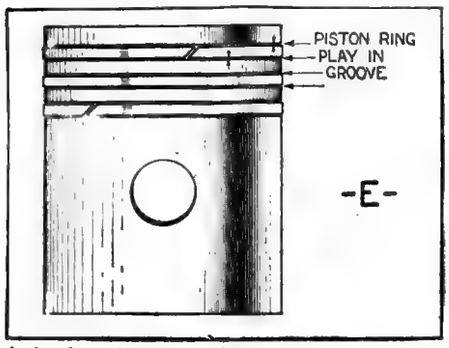
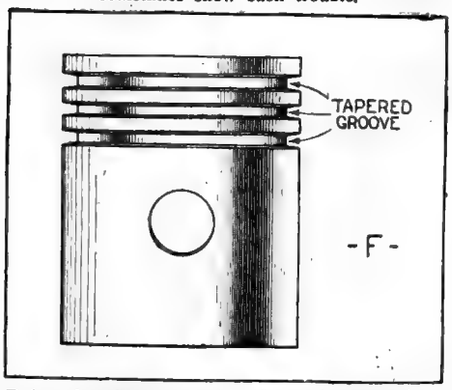
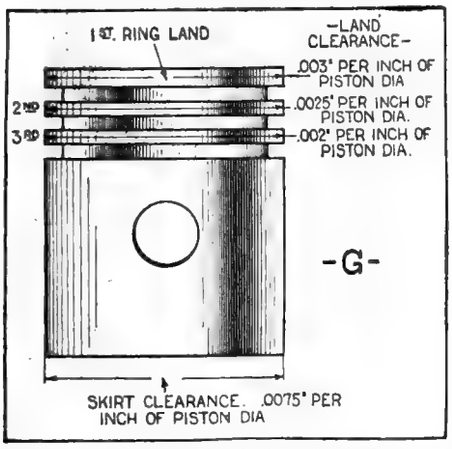


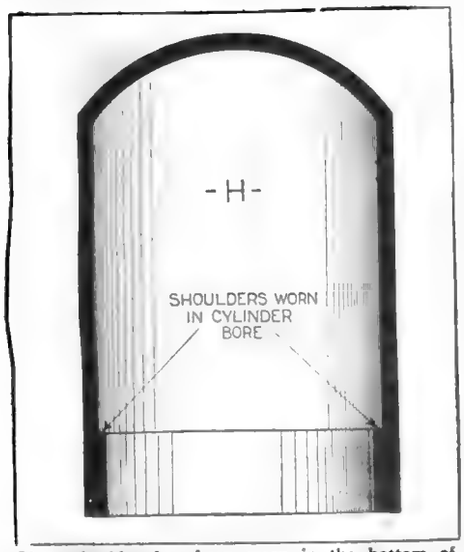
A ring loose in its groove is the cause of oil pumping and lack of compression. Even new engines sometimes show such trouble.



Before installing new rings in a piston examine it for groove taper. If the groove resembles the one above it should be re-turned.



Here is shown a good rule for piston clearance. The piston should be placed in the cylinder and tried, for if it is too tight scoring will result.



If a shoulder has been worn in the bottom of the cylinder as shown above, there is nothing to do but regrind the cylinder. This trouble also invariably causes a slight knock in the engine.

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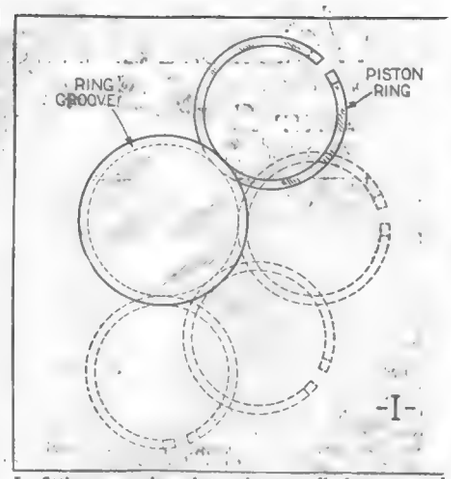
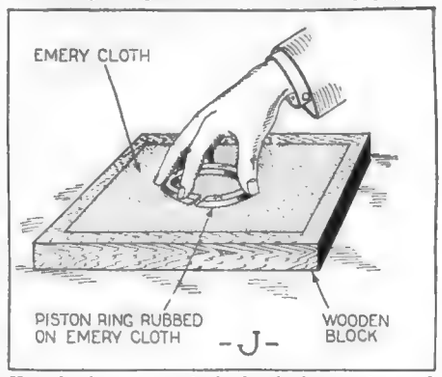
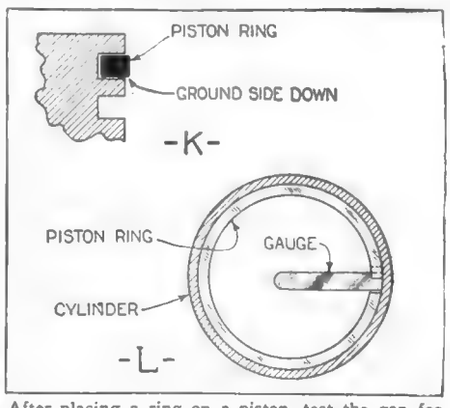


In fitting new rings into pistons roll them around the groove to see that they fit on all sides. If the ring is tight reduce it with emery paper.

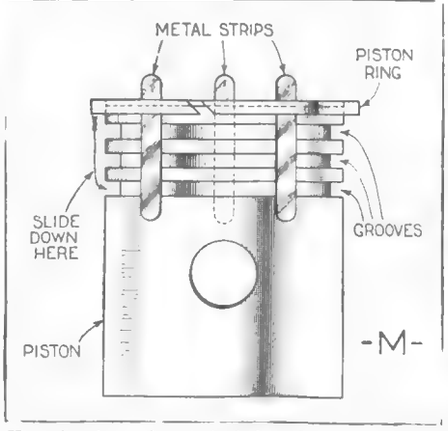


Here is shown a method of reducing a ring to fit a piston. On all rings it will be found that one side has been accurately ground. This side should be to the bottom of the groove.

This will reduce leakage on the compression stroke. If the ring has to be reduced, do the reducing on the roughly finished side. Mark rings so they fit their own grooves.



After placing a ring on a piston, test the gap for size. This is done with a feeler gauge. If the gap is too close the ends should be filed.



Here is given the method for placing the rings on the piston. Put on bottom ring first.

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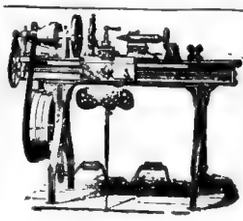

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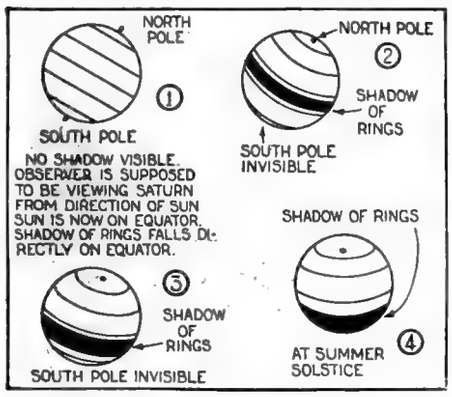
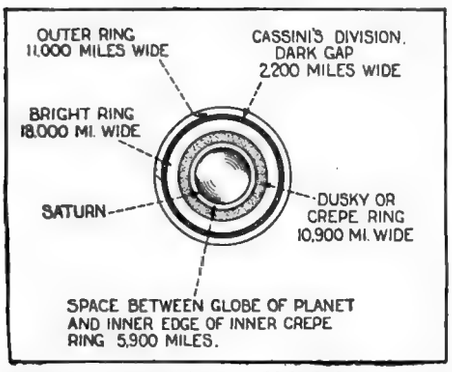
The Wonders of Saturn

BY ISABEL M. LEWIS

(*Continued from page 759*)



The shadow of the rings fall in different places over the surface of the planet with the passage of the seasons. At 1, the observer is viewing the planet from the side next the sun at the Vernal Equinox. The sun is in the plane of the rings so their shadow falls directly on the equator. At 2, the shadow is seen growing shorter as the equinox approaches. At 3, is its position near the Summer Solstice—mid-summer. At 4, is its position at the Solstice. The rings always fall on the side of the planet that is having winter.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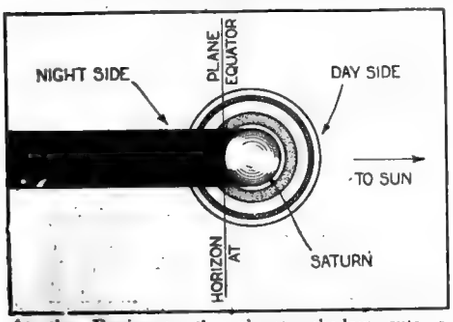
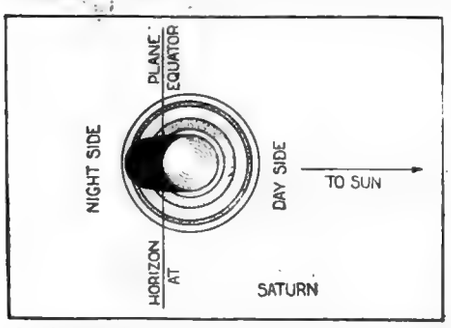
As Saturn and his rings would look from a point directly above her north pole, showing the division of rings and their width.



At the Equinoxes the planets shadow cuts a dark rectangle out of the rings leaving only a segment of them at each side of the horizon.



At the Solstices the shadow is shortened by the rise of the sun to the tropics so that the whole shadow of the planet is on the rings cutting a dark ellipse from them.

Crossroads of Conversation

Could the telephone directory in the hands of each subscriber be revised from hour to hour, there would be no need for the information operator. But even during its printing and binding, thousands of changes take place in the telephone community. New subscribers are added to the list. Old ones move their places of business or of residence.

Though their names are not listed on the directory, these subscribers must be connected by the highways of speech with all others in the community. To supplement the printed page, there must be guides at the crossroads of conversation.

Such are the information operators, selected for their task because of quickness and accuracy, courtesy and intelligence. At their desks, connected with the switchboards in central offices, they relieve the regular operators from answering thousands of questions about telephone numbers that would otherwise impede the rendering of service. If they are unnecessarily asked for numbers already in the directory, service is retarded.

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Book Review

THE SCIENCE OF INVENTION. A course in invention consisting of an introduction and twenty-five lectures. Published by the Bureau of Inventive Science, Rochester, New York. Each of the separate lectures and the introduction bound in paper. Also includes numerous problem cards, catalogs of reference works. Complete list of Libraries, as well as engineering and professional Association Libraries.

This course in invention is rather pretentious in its realm. It cannot be said that it does not cover the field. Beginning with a discussion on the nature of genius and the inventive trend of mind it follows on through a short course in concentration and memory with special attention toward creating, in the mind of the budding young inventor the right sort of mental habits.

Then there are lectures on what the inventor should know about mechanics, electricity, chemistry, physics, and sketching. These set out very briefly some of the more common laws of the branches of science under discussion in the chapter.

Then there are chapters on such subjects at "What not to invent," "Development of the labor saving device" and "Manufacturing Methods." But by far the best parts of the course are those dealing with the methods and practices in carrying out research work in connection with the ideas on which the inventor is working. In these lessons the course goes so far as to set out lists of libraries and bureaus where information may be obtained and the general procedure in obtaining books and literature from them.

The latter part of the course is given up to the intensely practical side of inventing such as designing the complete machine or device, with an eye toward making its manufacture the cheapest possible consistent with quality, with the obtaining of patents both U. S. and foreign with a discussion of what ideas should be patented and where.

At the back of each lecture there are practical problems in invention designed to give the inventor the proper trend of mind that will allow his imagination to work.

One of the most admirable things about the course is the more or less complete bibliography given with it to be used in connection with the course. It is a hopeless task to try to cover physics or chemistry in a booklet of a dozen pages so the author appends this rather good list of reference books.

The course may not enable the student to evolve a vacuum tube but it certainly will not leave him in the dark as to the practical way in which to go about his exploits in the field of discovery and design.

THE RADIO PATHFINDER. By Richard H. Ranger. 155 pages, illustrated, hard cloth covers, size 7½"x5¼". Published by Doubleday Page and Company, New York City.

This is one of the clearest books written on the subject of radio reception. In it the author makes use of little characters, such as we used to find in our nursery rhyme books which he calls positive ions, king electrons and negative electrons. These little figures enter into the explanations in the forms of diagrams and make very interesting reading. These little figures come in quite handy in explaining the action of the radio vacuum tube as the same can be clearly put forth with their use. In all explanations of the action of electrical currents in the various radio instruments, these figures are used to great advantage.

The text of the book is written in a very engaging and entertaining manner and at the same time gives authoritative information on the different phases of radio reception. The writer confines himself solely to this subject, that is reception, and in this manner presents a book which is of great interest to all classes of radio receiving fans.

A useful chapter, covering a phase of radio work which is usually omitted in other books is that on batteries. Storage batteries are thoroughly discussed and the necessary precautions in caring for them are taken up. Methods of charging storage batteries are also illustrated, making the chapter particularly of interest to the experimenter.

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RAILROAD ELECTRIFICATION. By Arthur J. Manson. Illustrated, 332 pages, hard cloth covers, size 8¾"x 5¾". Published by Simmons-Boardman Publishing Company, New York City.

In this book is outlined the principles involved in railroad electrification, in a manner meant for students of that subject and those actively engaged in the work. An explanation of Ohm's law is given and inductance and capacity are thoroughly explained. Various types of electric motors are then taken up and instruction is given on how to read the characteristic curves of motors. The operation of trains is then entered into and various phases of the running of electrical locomotives are treated carefully. Tables are given showing the general data on the operation of electrical trains in the United States and throughout the world. Electric and steam locomotives are compared as to efficiency.

The book can very well be considered as a text book for anyone desiring to study electrical transportation and its future.

THE AMERICAN BOY'S BOOK OF BUGS, BUTTERFLIES AND BEETLES. By Dan Beard. Illustrated. board 8¼"x5½", 304 pages, Lippincott, Philadelphia.

Dan Beard, the great naturalist and woodcraftsman of the American boy, has written this treatise on some branches of entomology, as specified in the title. All the way through the book he maintains a simple style, and a reduction of terms and words to their simplest forms that makes the subject matter perfectly clear, even to the veriest layman. Full directions for the collection and mounting of specimens are given and great care is taken to show the young student the why and the wherefore. The subject matter is divided into three divisions. They are: The beetle family, the butterfly and moth family and the lower forms of insects. Full description is given of each of the species described. Several of the fundamental facts of biology are brought out in the course of these descriptions. Special attention is given to distinguishing those insects that are harmful and those that are helpful to man and his work.

The whole subject is set out clearly so the boy —or man, for that matter—who hasn't any training in science may read the text, follow the illustrations, and finish this enjoyable book without failing to understand a single sentence or thought the author has set down. He will learn a great deal about the life, habits and formation of the insect kingdom.

THE WEB OF DESTINY. By Max Heindel. Frontispiece, 7¾"x5¼", 187 pages, including blurbs. Board. The Rosicrucian Fellowship, Oceanside, Calif.

This may be termed another one of those Spiritualistic things now prevalent. The author, evidently, has heard of such things as instincts, lower nerve centers, brain cortices, et. al. He looked upon them and decided they were good for another religion. It seems that a great many men, once they find something new to their mind, something exotic in the field of science, or some branch of study in its infancy, must immediately set to get the known facts, under different names, into some sort of religion.

It must be because a certain type of intelligence is very impressionable. Immediately they fall on something that is rich in theory and rather shy on fact, they proceed to fill the deficiency in fact by supplying a wealth of imaginative detail.

Heindel, however, has a quite interesting arrangement of bodies which seem to take the place of the instincts, the spiritual and the intelligence, in the works of the more conservative religionists.

It is worth reading just for the sake of his point of view of psychology—that is, if it is not taken too seriously.

DIESEL AND OIL ENGINE HANDBOOK. Julius Rosebloom. Illustrated with diagrams, plans and photos. 5"x7". 376 pages, bound in imitation leather. Published by the Technical Publishing Co., Los Angeles, Calif.

A long felt need for a volume such as this one has been, at last, filled. It is written from the point of view of the actual operating engineer, the one who stops and starts the engines and who cares for them. It contains an explanation of the working principles of the machines, but the emphasis is placed on a thousand and one little things that the draughtsman and engineer never think about. Those little things that cause the hard pressed engineer to make the air blue with swearing and bring him to a premature grave, those little worries that only the actual operator knows.

It deals with both the marine and stationary types, fully, but never profusely; sets out in plain language easily understood the weak and strong points of each type and gives many hints that may prove extremely useful. The auxiliary apparatus is also fully covered. An appendix with calculations follows, which is a very useful addition to the text.

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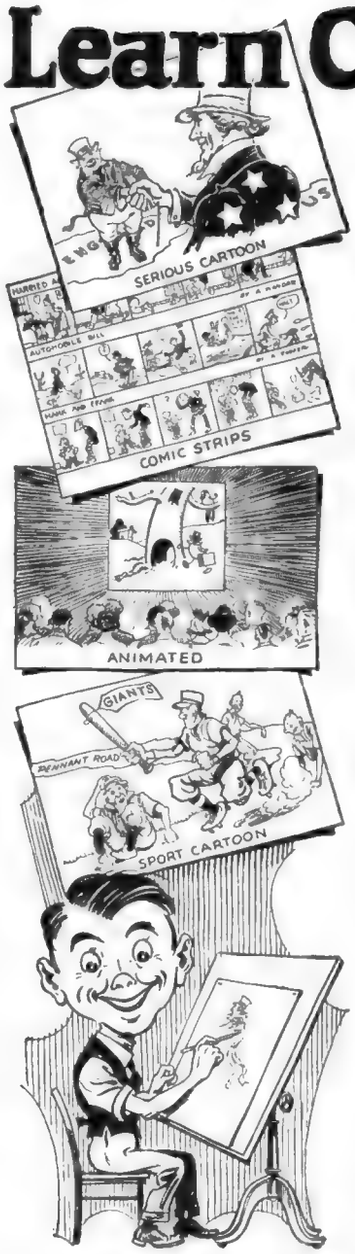

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THE PLANET MARS AND ITS INHABITANTS. By Iros Urides (A. Martian). A Psychic Revelation written down by J. L. Kennon. 102 pages, paper binding, 5"x7½". Published by the author.

We poor earth worms will have to struggle along as best we can, according to Mabel J. McKean, the medium who says she saw the wonderful things which appear in this little volume, for several thousand years before we will reach the spiritualistic heights that permit the Martians to enjoy their perfect communism. As a matter of fact, we earthly people cannot understand the great spiritual truths that enable the Martians and Mrs. McKean to get at the foundational facts of life and science. They are much nearer a speaking acquaintance with the Almighty than we poor benighted souls. But, Mrs. McKean says to just bear with us a little while, to give us a little time and we may learn to enjoy life, like the Martians, if we follow the right leaders. The Martian who made the revelation to the lady in question says that Christ visited that planet several thousand years ago and told them to build the canals. The Martians, by the way, didn't crucify him, according to Iros.

LIGHTING CIRCUITS AND SWITCHES. By Terrell Croft. 472 pages. Board bound, profusely illustrated with diagrams and photos. McGraw-Hill Book Company, New York.

There is no reason why another book should be written on lighting circuits. This book covers the field from the smallest one-lamp circuit to the method of wiring a theatre for illumination. It covers the field thoroughly. In the preface the author states that the book is designed primarily as a hand book for the practical men. For that purpose it is excellent. But all contractors, designers and engineers would do well to have a copy of this volume on their shelves. There are few problems that may arise in connection with illumination circuits on which something is not included.

The National Electric Code rules and regulations are fully discussed in connection with the various pieces of apparatus, and the best methods of installation are shown. Proper location of leads and the placement of the various subsidiary devices is treated of.

PLASTICS AND MOULDED ELECTRICAL INSULATION. By Emile Hemming. Illustrated with drawings and photos. 310 pages, 9¼"x6". Board bound. The Chemical Catalog Co., New York.

The first half of this volume is devoted to one of the oldest arts of the earth—plastics. The study the book makes of plastics is not what might be called exhaustive but it will give a very good general idea of the chemistry employed in making the various cements and refractory substances so much in use today. At times it almost drops to the level of a book of formulas. The amateur will find a great many helpful hints and the value of the book to the professional laboratory man and experimenter is undoubted.

The latter half of the book is given over to the modern art of making electrical insulation. The whole field from the porcelain cleat to bakelite is covered.

THIRTY YEARS OF PSYCHICAL RESEARCH. By Charles Richet, Ph.D. Translated from the French by Stanley DeBrath. 6"x8½", 629 pages. Board. The McMillan Co., New York.

The French Doctor of Philosophy under whose name this book is brought out has collected together pretty much all the recent developments in the psychical field. The book doesn't take on so much the form of a history as it attempts to show the development of the alleged phenomena over the stage covered. By staying close to scientific terms and keeping the language and style dry and matter-of-fact the author or the translator one or the other is guilty of making the book lack life.

It mulls along for all the 600 pages without a great deal of organization—stating observations here, fancies and theories there, in such a manner as to leave the reader in the dark most of the time.

It has the advantage, however, of being as close to a true scientific discussion of the matter as has come from the presses in late months.

LIGHT, COLOR TONES AND NATURE'S FINER FORCES. By Ernest J. Stevens, M. Sc., Ph.D., 7¾"x5¾". Frontispiece. 268 pages. Published by the author.

This treatise is a semi-religious affair which attempts to disclose the secrets of life through the medium of vibration. It hooks up the shorter vibration of light and color, picks up some copy from the experimenters with ultra-violet and infra-red rays, uses some of the radio wave lengths, then seeks to fill the gap between the radio and the light waves by finding what it calls the life waves.

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The book is given in the form of lessons. There are fifty of them and each deals with some sort of waves. The author has found several new varieties, it would seem. It is not quite clear what it is all about, but then some things never are clear to the obstinate mind that likes to take its religion in the good old-fashioned way.

THE RIDDLE OF THE RHINE. By Victor Lefebure. Illustrated, 8¼"x5½", 274 pages with introductions by Marshal Foch and Field-Marshal Sir Henry Wilson. E. P. Dutton, New York.

To those of us who had to rely on newspaper accounts alone of the happenings at the front during the war, this little book will be of great interest as to the methods of chemical warfare. The study begins with the developments of gases as combatant elements early in the late Great War and traces the advances made to a place high in importance among the instruments of war. It is surprising how very little has been published on this new method of warfare, a method which promises to vie with the airplane in the next war, if it does not exceed the methods of aerial warfare in importance.

The author goes into the types of gases used and their effect on plants, animals and man. He gives most interesting data on the lethal and other effects, the durability and transportation of the various gases used. Then follows a detailed history of the use of gas in the work of the great opposing generals.

There are two chapters at the end of the book dealing with the problem of gas disarmament. The author's point of view is surprisingly clear of bias and he discusses the subject with intelligence and logic. After finishing these final two chapters, one is left to think that the statesmen who gathered at Washington for the Disarmament Conference should have given more attention to gas and less to battle cruisers. It is one of the best books on the scientific side of the war that has been published, to the mind of the reviewer.

THE PSYCHIC LIFE OF INSECTS. By E. L. Bouvier. Translated by L. O. Howard, M.D., Ph.D. Illustrated, 377 pages, size 5" x 7½". Published by The Century Co., New York City.

This book, which is devoted to the intelligence of insects, is really quite a remarkable treatise. Numerous individual instances of insect intelligence are given with its very definite limitations. Some very interesting examples of hereditary habit are given, and among the authorities cited, it is interesting to find the great Fabre, whose books are charming, but whose biography as written by one of his friends, showing the man's great amiability and his simplicity of life, is still more interesting. The present is a book of rather concentrated information and hardly can be called light reading, but is very well put and comes from a very eminent compatriot of Prof. Fabre. A good deal of very interesting material has been written on the subject of insects; and Thoreau's description of the battle of the ants with its allusion to a preceding description of many years before is a sort of classic. Most vivid descriptions of the ants in the tropics have appeared in our periodical literature and a vivid realization is afforded of how terribly dangerous they are.

HOUDINI'S PAPER MAGIC. By Houdini. Fully illustrated, 206 pages, size 5¼" by 7¾". Published by E. P. Dutton Co., New York City.

This book is a veritable treasure of parlor amusements. We do not mean to say that the celebrated author does not tell tricks worthy of production on the stage, but the book will be found an exhaustive treasure house for the home circle. We were interested in noting a number of chapters on paper folding, and some years ago SCIENCE AND INVENTION published an article with numerous illustrations on the special application of paper folding for the solution of geometrical problems, which is one of the most entertaining applications, but here we have many of the things we used to make out of paper when we were children, and on page 130 we find the famous "Trouble Wit." This is one of the oldest paper folding amusements known. It will be found very incompletely described in old time books on amusements, and it would be interesting really to run it down to earth, as they say, and find out who originated it and where. The writer has prepared the folded paper himself a number of times, and found that it required a considerable amount of care in its preparation, and he has found it advantageous after the folding to dampen it and put under very heavy pressure, as between wood clamps, or between boards in a vise. The paper, too, wants to be of good quality, and above all wants to be large enough. Another old friend we find in the book is the paper rings. The most curious effects are produced by pasting bands of paper into rings and cutting them into two, all sorts of interlacings being producible by simply cutting with the scissors. Besides old friends, we believe that most people will find in this book considerable that is new to them, for so much can be done with paper that it supplies almost an exhaustless field of the lighter type of amusement.

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EDITED BY
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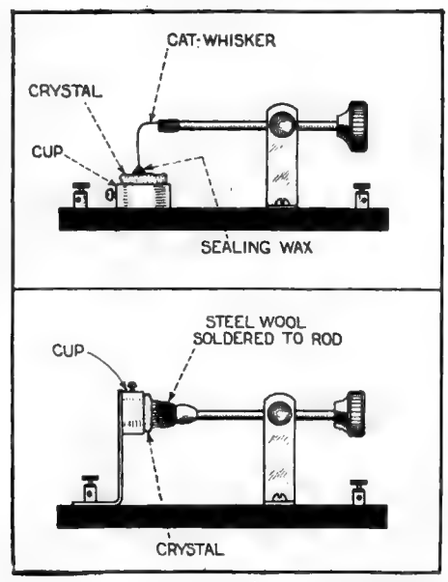
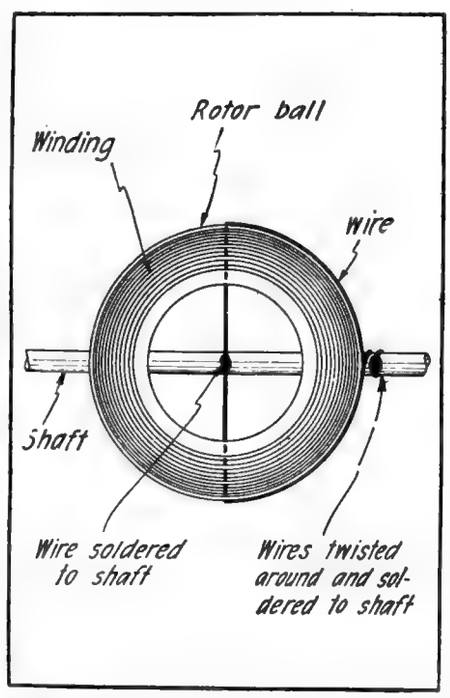


Upper: A drop of wax will hold the cat-whisker on a sensitive spot. Lower: Steel wool makes an excellent substitute for a cat-whisker.
—W. T. Markowski.

FASTENING ROTOR BALL



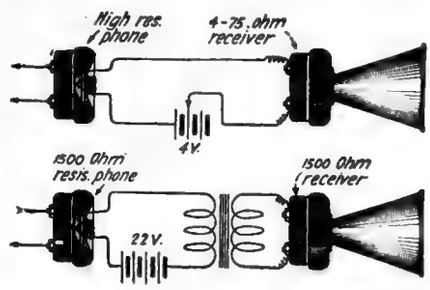
Drill two holes in opposite sides of the rotor ball, as shown. Pass a stiff wire through them around one-half the ball and solder to center and end of shaft. The rotor will be held rigid.
—Fritz Vanderwerth.

How to Hook-Up A Transmitter Button to Make an Efficient Loud Talker

A Transmitter button with a few dry cells and a telephone receiver will make a remarkably simple and efficient loud talker. A Microphonic amplifier of this type is just the thing for use with a radio set. The weak music and signals may be amplified many times their original value. It is possible to entertain a large audience with a simple radio equipment if a transmitter button is used in the circuit as explained in diagram A.

The cost is extremely low and the results are comparable with those produced by highest grade of expensive loud talkers.

As may be seen in the diagram, two dry cells or a small storage battery are connected in series with the transmitter button and a 4 to 75 ohm telephone receiver. The transmitter button is secured to the diaphragm of the telephone in the radio receiving set. To accomplish this properly, scrape off the enamel (if diaphragm is enameled) on the face of the diaphragm and solder the small hexagon nut supplied with the button to the exact center. Care should be taken that the thin diaphragm is not bent or otherwise



harmed. The transmitter button is then screwed into place. Connections, as shown in the diagram, are made with flexible wire. A horn may be placed over the low resistance receiver if desired. When the radio set is properly tuned and signals are being received, the transmitter button is operated by the vibration of the diaphragm of the receiver. As the receiver diaphragm vibrates, the mica diaphragm on the transmitter button also vibrates. The carbon grains are compressed at varying pressure; the current flowing through the local battery circuit is thus varied and results in an amplification of the sounds in the low resistance telephone loud-talker.

Diagram B, which includes a step-up transformer, is to be used with loud talking receivers of high resistance. The primary of the transformers should have a resistance of about 75 ohms. An ordinary telephone induction coil will serve as the transformer in this circuit.

You can get the above-described transmitter button FREE in subscribing to "Practical Electrics Magazine" at $2.00 per year (12 months). Send your subscriptions today.

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—Adv.

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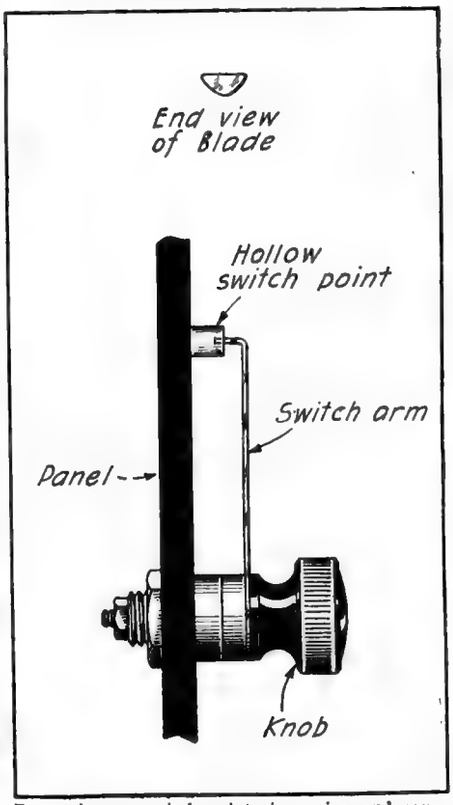
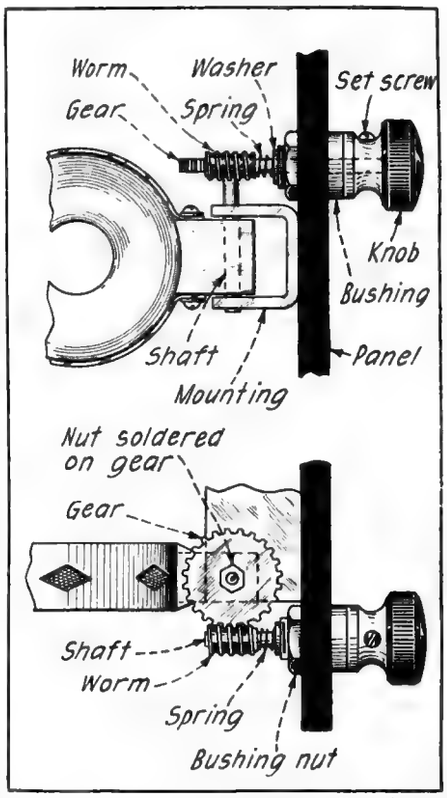


By setting up switch points in a vise, and countersinking slightly with a drill about the same diameter as the switch point, an excellent contact surface will be formed. The end of the switch arm should be curved as illustrated, so as to fit into the end of the contact point.

—Lloyd Jacquet.

MICROMETER COIL SET



One of the greatest bugbears attending the use of honeycomb coils is satisfactory adjustment. This can be overcome by mounting a gear wheel such as found in toy engineering sets on a shaft running through the mounting, and turning it with a worm gear. The lay-out of such an arrangement is shown above. The spring holds the worm in position and prevents loosening of the shaft. The primary and tickler coils may be mounted in this way, with the secondary stationary between them. The entire mounting may be placed behind the panel.

—John Skerbits.

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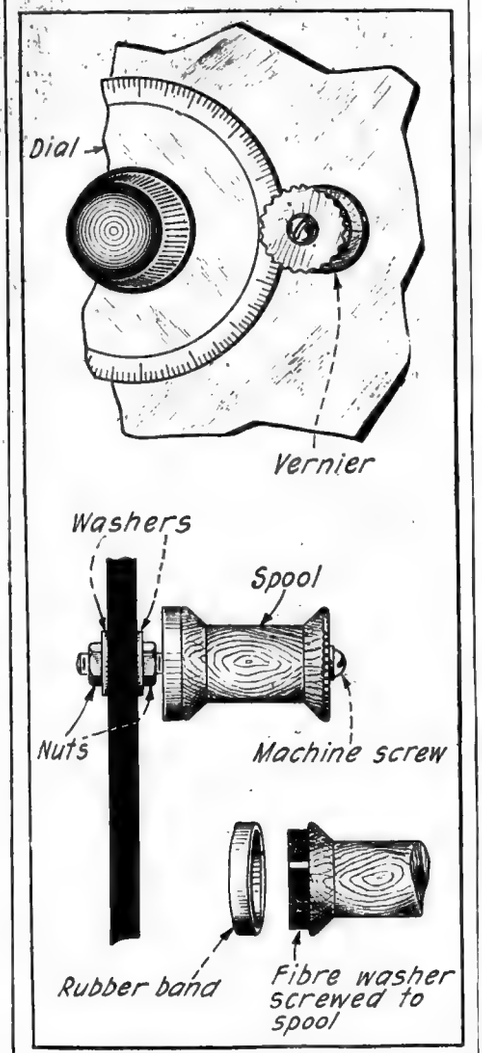
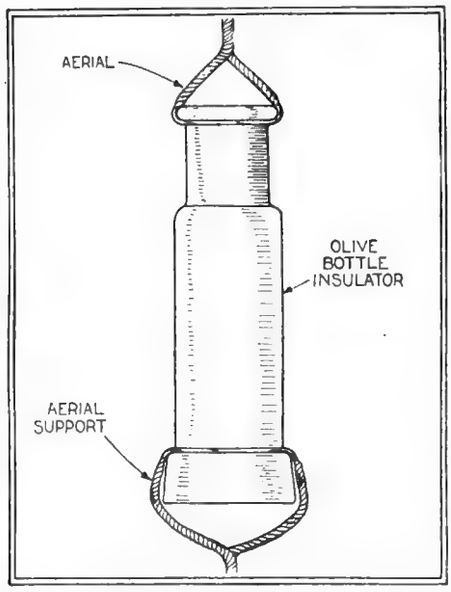


An exceedingly simple yet efficient vernier for use on any instrument may be made as illustrated above. A fibre washer is attached to an ordinary spool and a rubber band slipped over the edge of the washer. A machine screw supplies the mounting. The vernier should not be drawn up so tight that the edge of the spool cannot be slipped away from the edge of the dial when coarse tuning is desired. —L. B. Robbins.

CHEAP INSULATORS



Olive or pickle bottle with a flange at each end make cheap and efficient antenna insulators. Bridles are fastened to each end as illustrated above. These insulators will stand quite a strain and at the same time furnish adequate insulation.
—Willard R. Balbou.

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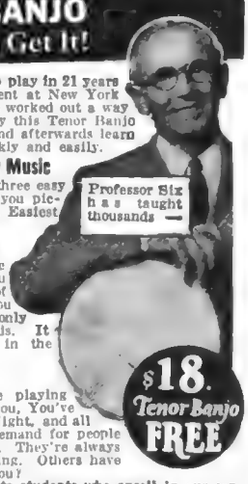

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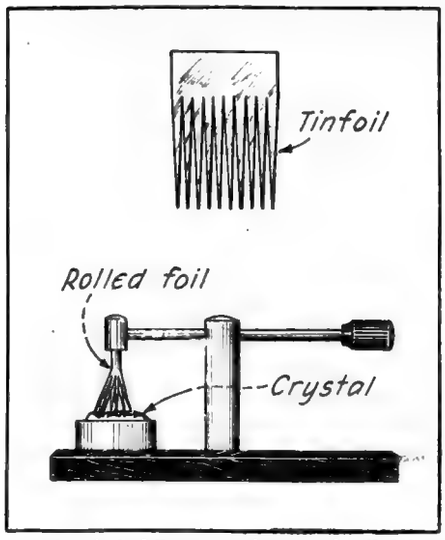
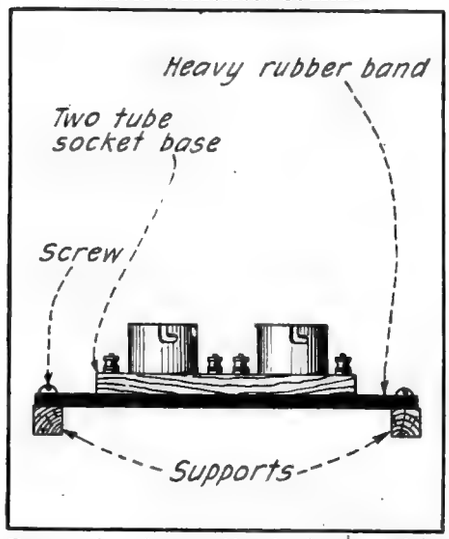


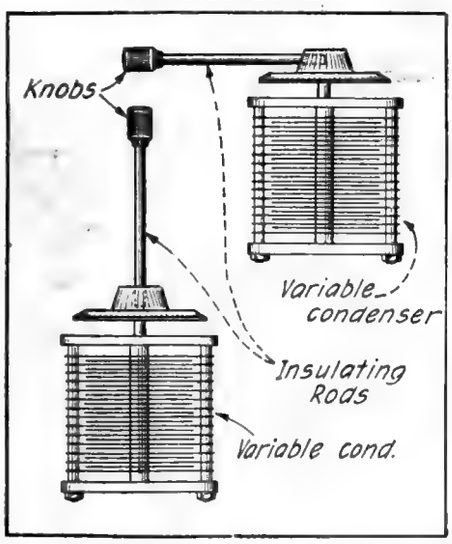
A strip of tin-foil cut as shown and rolled into a cylinder at the top makes an excellent cat whisker. —A. W.

ANTI-VIBRATION SOCKET



Two or three heavy rubber bands stretched between two wooden supports and fastened with clamps or screws make an excellent base for mounting tube sockets. —L. J.

ANTI-BODY CAPACITY



It is often desirable to tune condensers from a distance so the capacity of the body will not affect them. This may be done by drilling and tapping holes in the knobs of the condensers and attaching threaded rods as illustrated above. The condenser can then be tuned by means of the small knob. —L. J.

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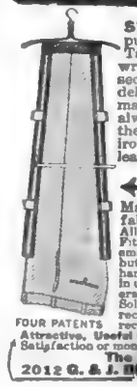

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32x3½	6.80	1.50	34x4½	9.15	2.50
31x4	7.00	1.60	35x4½	9.25	2.60
32x4	7.50	1.85	36x4½	9.45	2.70
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ALL OUR TUBES ARE NEW FRESH STOCK and Guaranteed for One Year. Shipment made same day order is received. Pay on arrival and if not satisfied, return AT OUR EXPENSE. Specify whether straight side or clincher wanted. FIVE PER CENT DISCOUNT when cash accompanies order. DEALER AGENTS WANTED IN EVERY LOCALITY.

STANDARD TIRE & RUBBER CO.
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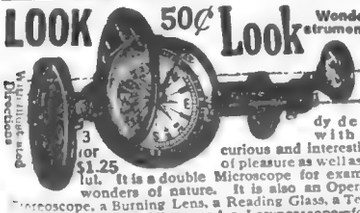
LOOK 50¢ Look



Wonderful instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Telescope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngascope—for examining eye, ear, nose and throat. It is worth all the cost to locate one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail with 300 page Novelty Catalog, ONLY 50c or 3 for $1.25

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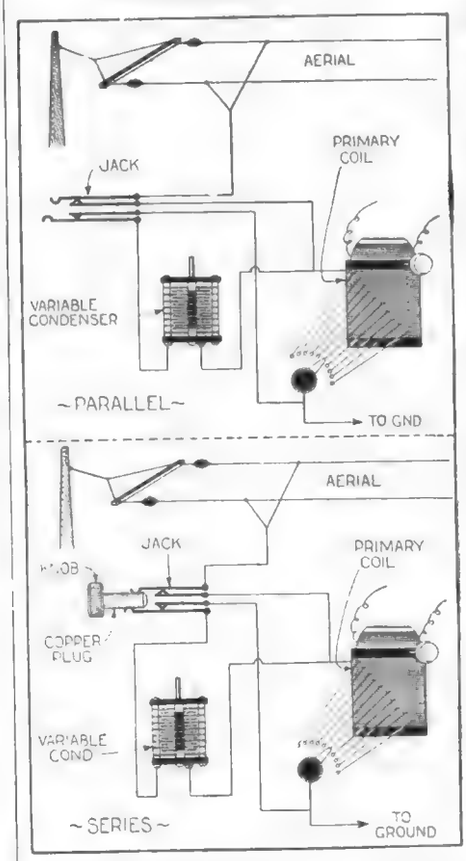
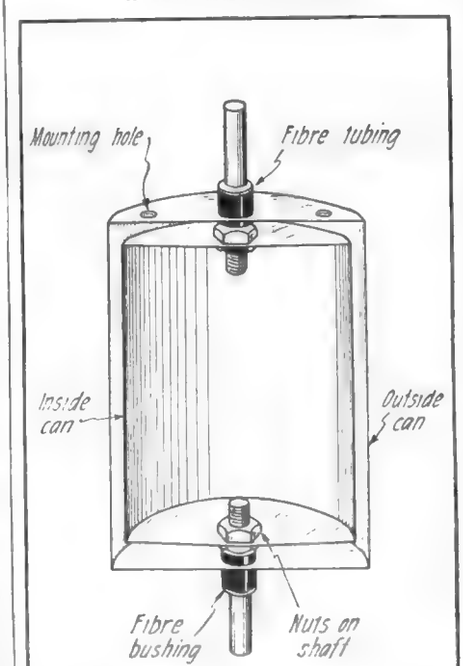
SERIES-PARALLEL JACK



A very handy arrangement to be used in place of a series-parallel switch consists of an ordinary two-circuit jack and a piece of copper rod with a knob. The rod should be the same diameter as the telephone plug and the connections are made as shown. The insertion of the plug will connect the condenser in series with the inductance and withdrawing the plug places the condenser in parallel. —L. Ringer.

A TIN CAN VARIABLE



To make this very simple variable condenser, obtain two circular tin cans, one slightly shorter and smaller in diameter than the other. Cut each one in half, longitudinally, as shown. Drill two holes in the smaller one for clamping the shaft and insert sections of shaft, threaded on one end as illustrated. By clamping the shafts to the inner can with two nuts, a very serviceable variable condenser capable of being mounted on a panel will be obtained. —Edgar Smothers.

World prices are possible because it costs the World Battery Company only one-half as much to sell World batteries. That is the reason we can spend just as much to build our batteries as any other big company. That is the reason we can stand behind every battery we put out with a written 2-year guarantee. You take no risk when you buy a World battery—service is certain.

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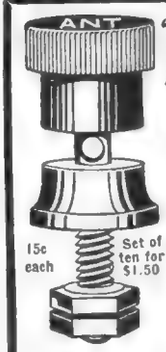

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$2.25 Prepaid

Dealers are invited to write for proposition on this and other Simore tools.

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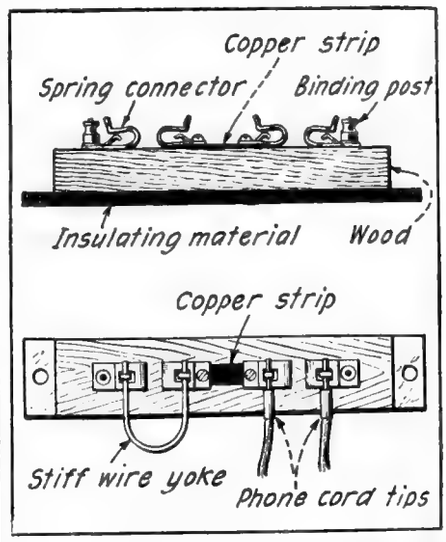
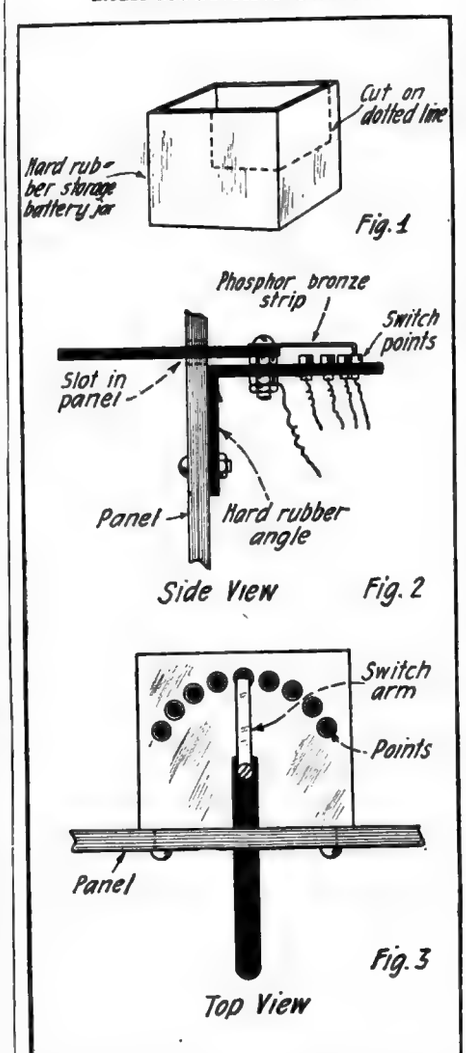
PHONE CONNECTION



A strip of wood, a strip of insulating material and several spring binding posts with miscellaneous screws and bits of copper, make an excellent yet inexpensive connection block for connecting various pairs of phones in series. The stiff wire yoke is to short-circuit adjacent clips when phone tips are not used. Such a block may be extended as much as necessary. —L. B. R.

BACK-MOUNTING SWITCH



By sawing out a section of a storage battery jar, a right-angular strip of hard rubber will be obtained. On one arm of this angle may be mounted switch points and contact arm. The other is bolted to the back of a radio panel. A slot may then be cut in the panel and an extension insulated arm run through it. —John N. Quinton.

Earle E. Liederman
as he is today

Call the Undertaker!

What's the use of living when you're only half alive? You get up in the morning and you don't have the pep of a jelly fish. Your work is a burden and life has ceased to give you a thrill. You don't seem to get anywhere and nobody cares whether you do or not. What's the use, fellows? Call the Undertaker, for you're dead and you don't know it.

A New Life

Stop! It's all wrong. There is another life right here before you. A new and a better one. A life that is full of thrills and sunshine. Every day opens new worlds to conquer, new joys, new friends and lasting ones. Come with me and let me guide you to it.

I have a system that knocks those gloom bugs higher than a kite. I'll put pep in your old backbone that will make you feel like a jack rabbit. I'll put a spring to your step and a flash to you eye so that your own friends won't know you.

Health and Strength

That's what you need and that's what you get. Come on now, pull in your belt and throw out your chest. Take a good deep breath of that pure air that's all about you. Give your heart a treat with some rich blood. You will feel so good you will think it's your birthday. Drop me a line and I'll show you how to do it. I'm going to put a chest on you that will make your old ribs strain with the pressure. I'm going to change those skinny arms and legs of yours to a real man's size. You will have the strength and vitality to do things you never thought possible. Come on, fellows! Get busy. I don't promise these things—I guarantee them. Are you with me?

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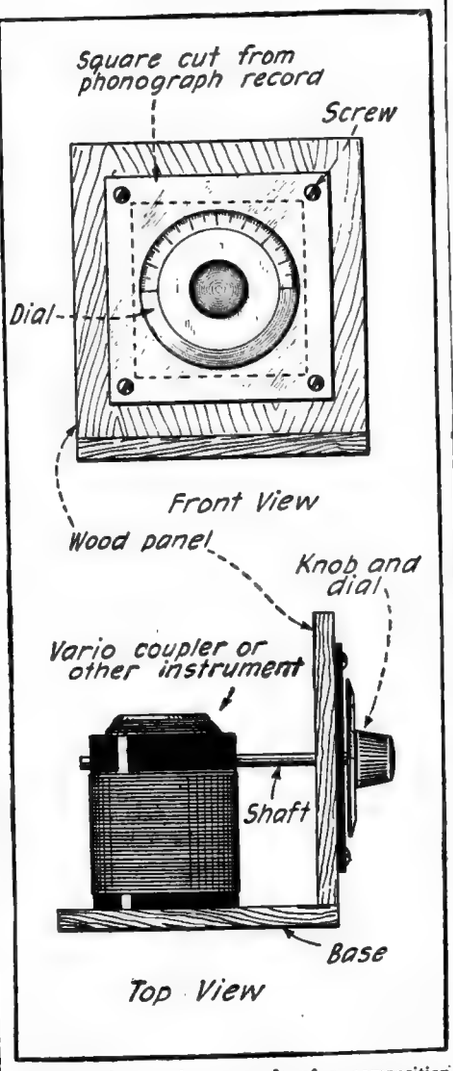
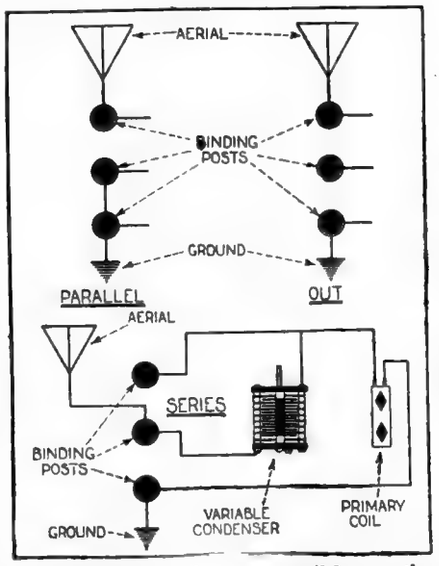
If interested in becoming a teacher-agent check ( )

UNIT PANELS



Phonograph records are made of a composition which is a very good insulator. If squares are cut from them and mounted as illustrated above a neat and efficient unit panels will result. Switches or other apparatus may also be mounted on these panels. A large square hole is cut in the wooden panel and the square cut from the phonograph record screwed thereon. —D. Adams.

BINDING POSTS



A jumper is used as parallel connection but is removed wh is not used in the circuit. The are connected to the center ar posts respectively for series

L. Robinson.

Radio Bargains for THIS MONTH

Hedgehog Transformer	$3.15
Reflex Crystal	.89
Battery Test Clips (each)	.05
199 Tube Adapter	.49
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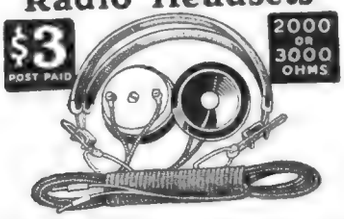

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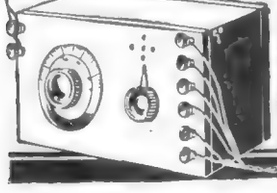

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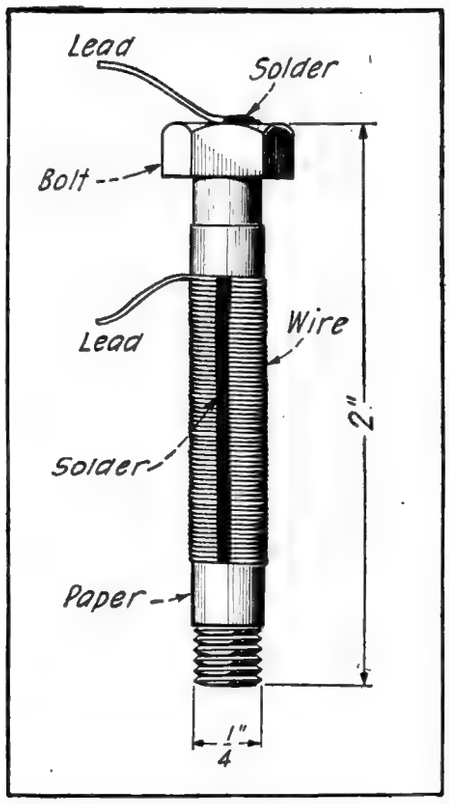
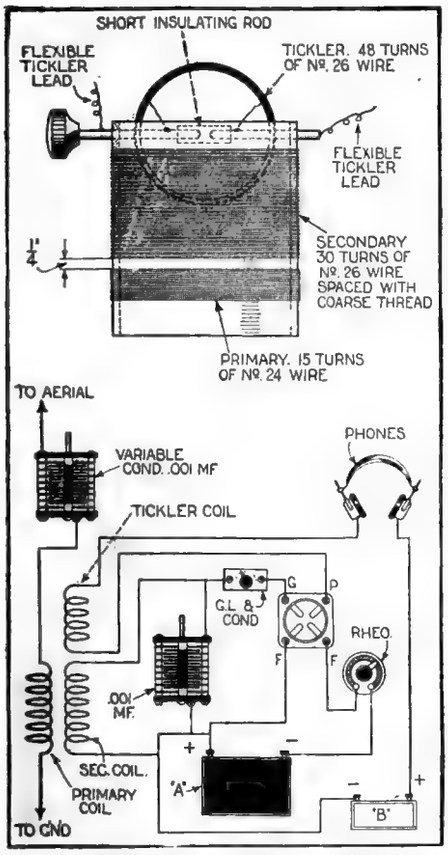
GRID CONDENSER



A semi-variable grid condenser is made as illustrated. By winding more or less turns of wire over the waxed paper, the desired capacity is obtained. The bolt used should be of brass. The wires are soldered as shown so as to hold adjacent turns together. L. J.

FIXED COUPLING TUNER



A very simple receiving tuner, consisting of primary, secondary and tickler coils, is made from an old vario-coupler following the data given above. This circuit gives excellent results and the tickler coil provides regeneration. Only three controls are used, thereby simplifying the operation of the set. —Jack W. Morton, Jr.

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I am enclosing herewith $1.00 to pay for the Radiogem. I had it carefully wound by our wireless operator and find that it works beautifully—**fully as good as any crystal set we know of.**

Radiogem received, which we assembled and were very much astonished at results obtained and the clearness and volume of tone produced.

The greatest distance I heard on one of your sets is 1000 miles, having heard WGY at Schenectady, N. Y. I think **your set is the best I have ever sold at any price.**

Herewith P.O.M.O. amt. $1.00 for another "RADIOGEM." The one received is O.K. Placed about 15 ft. of picture cord under front porch and grounded to a gas meter, and heard the Sacramento Bee and Sacramento Broadcasting Union **much better than with my large crystal set.**

Your RADIOGEM RECEIVER is a wonder. **I have received every station in Philadelphia with it much louder than with a high-priced crystal set.**

Your two Radiogem sets received last night, and one was wired up for testing. WOC is about 40 miles away, and their signals could be heard with headphones on table. After they quit KYW at Chicago about 170 miles east was heard. Every word could be plainly heard here.

You claim a radius of 20 miles over your "Radiogem" is sometimes a possibility. You should adhere to the truth. I constructed one for my mother, installed it with an aerial, and she listens not once in a while, but at her will, to Schenectady, Newark, New York, or Providence, R. I., and her home is Attleboro, Mass. **I can't give your set too much praise.**

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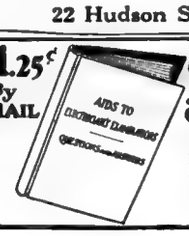

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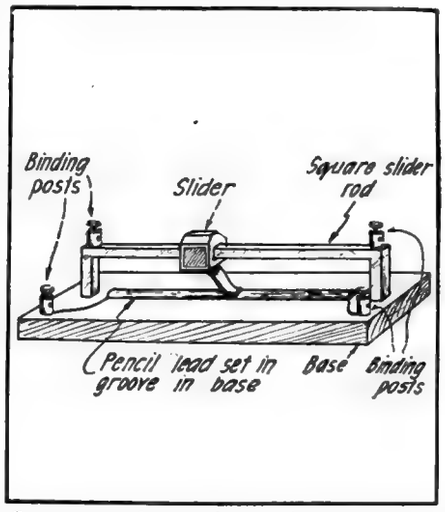
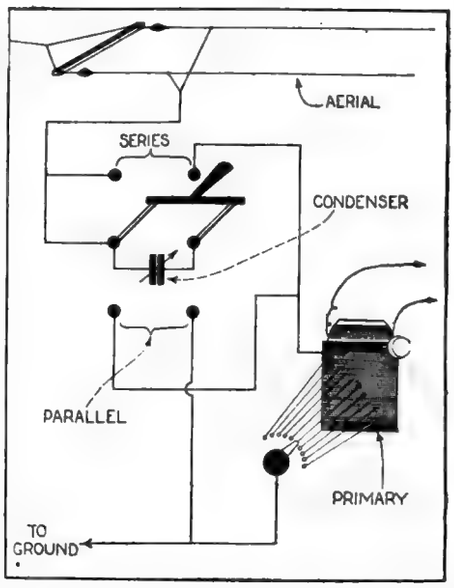
EFFICIENT POTENTIOMETER



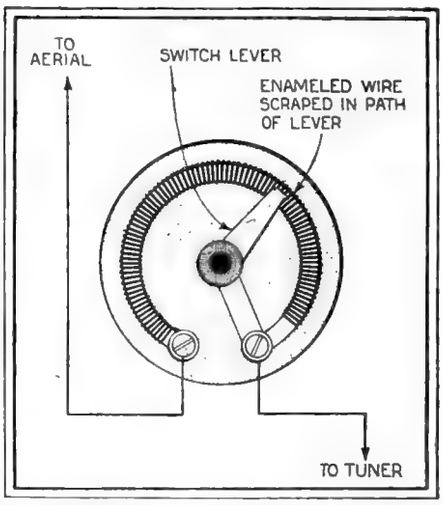
Some scraps of square brass rod, a slider, a piece of soft pencil lead and binding posts comprise a very good yet cheap potentiometer when assembled as shown above. The pencil lead should be fastened in the groove with glue.
—Charles J. Coward.

SERIES-PARALLEL SWITCH



A double-pole double-throw switch makes a very effective series-parallel connection on any receiving tuner. The hook-up is given above. It is advisable to use a small switch which can be mounted on the front of a panel.—S. H Cornell.

VERNIER TUNER



A vernier tuner to be connected in series with the primary of the regular tuner may be made from the rheostat. —Ernest Kocak.

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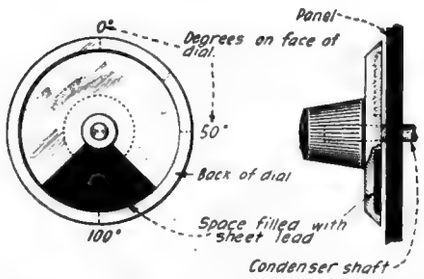
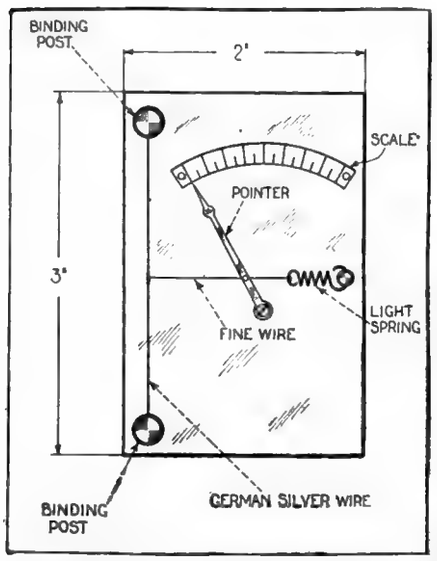
BALANCING DIALS



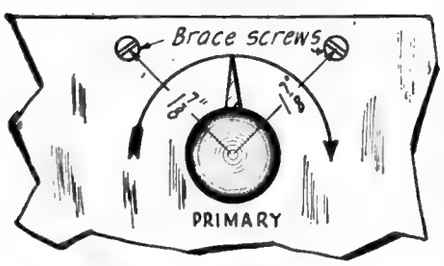
By filling up a part of the countersunk space in the back of a dial with a piece of sheet lead as shown, a counter-balance for the rotary plates of a variable condenser may be formed.
—Stanley G. Mitsuo.

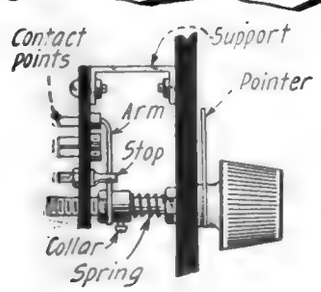
HOT-WIRE AMMETER

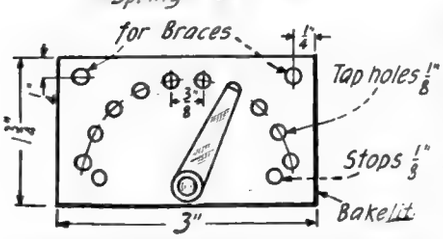


A fairly accurate ammeter operating on the principle of the expansion of a hot wire may be constructed as shown above.
—John R. Good.

INDUCTANCE SWITCH







Above will be found the constructional details for an inductance switch to be mounted back of a panel.
—George A. Sherwood.

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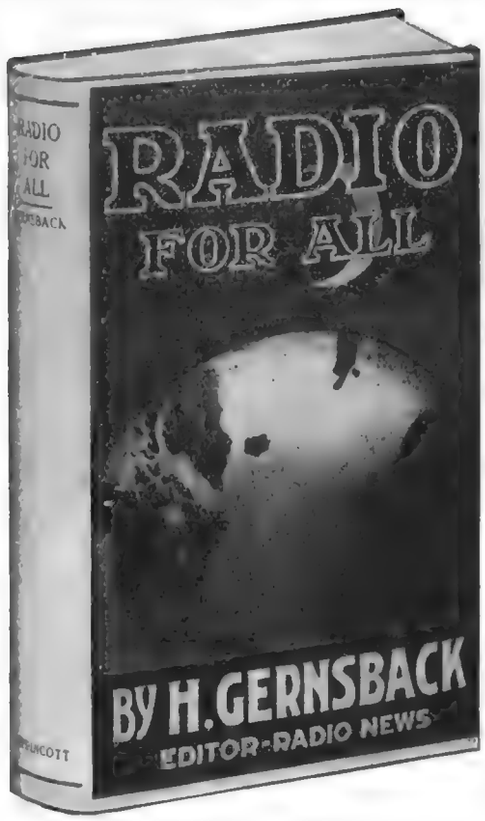

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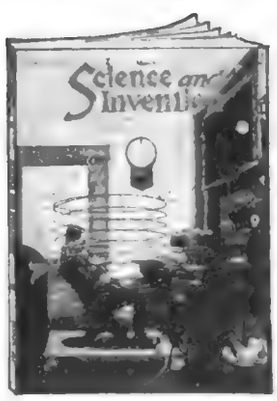

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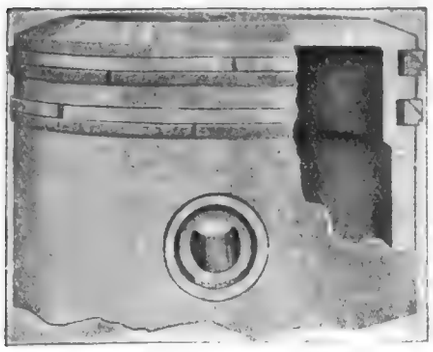

In the manufacture of the ring shown above, the outer section which presses against the cylinder wall is made of a soft, non-resilient iron compound that resists wear as well as the ordinary ring and at the same time does not bore. The inner ring is made of an entirely different compound and is equiradial in expansion, thus delivering an equal pressure at all points around the cylinder wall. The face of the inner and outer rings meet at an angle of fifty degrees. The outer section of the ring is called the packing section and the inner the spring section. The new ring does away entirely with pins.

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Of SCIENCE AND INVENTION, published monthly at Jamaica, New York, for October 1, 1923.

State of New York } ss.
County of New York }

Before me, a notary public in and for the State and county aforesaid, personally appeared H. Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the SCIENCE AND INVENTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

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H. GERNSBACK.

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JOSEPH H. KRAUS,

(My commission expires March 30, 1925.)

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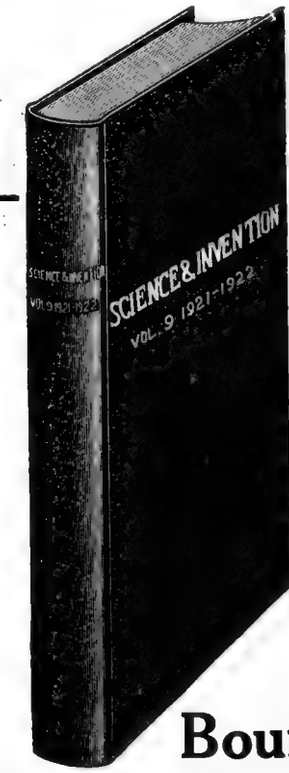

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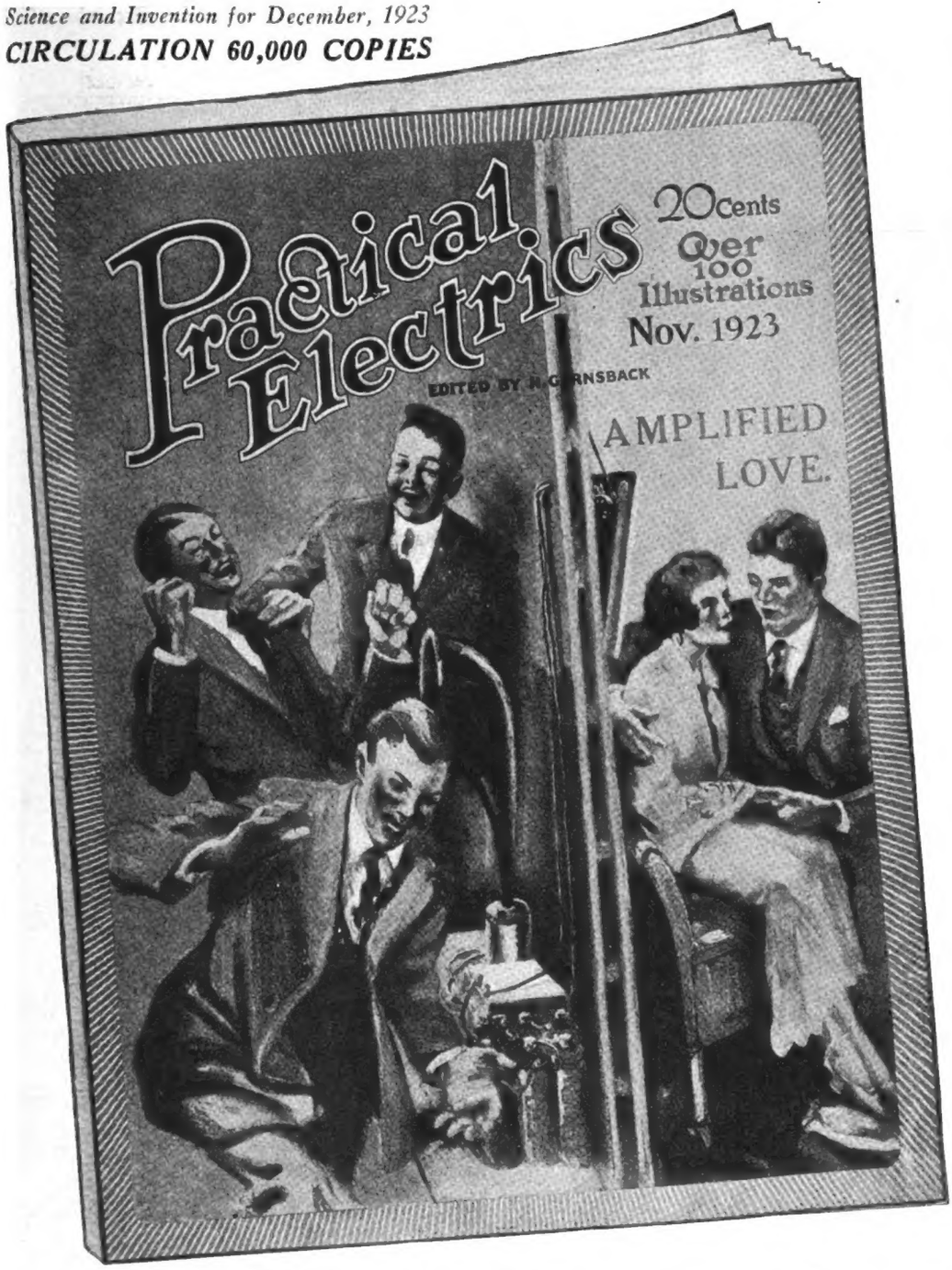

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This Free Book Will Show You How to Earn $1,500 to $10,000 Yearly as a Radio Expert

THE man who would be a success in business today must be a specialist. The market is already crowded with clerks, stenographers, accountants and detail men of every description. And as the number of applicants increases, the pay and opportunities diminish. Not that these men are unnecessary, for their work is important and essential. But the competition has always been keen in general work of this kind and it is bound to increase in proportion to the number of good men available.

Radio Needs Trained Men

There is perhaps no other field today where specialists are needed more than in Radio. Trained men are required in every branch of this fascinating, profitable profession. And the opportunities are great—almost without limit! Radio has swept across the face of the whole earth with a speed as surprising as it was sudden. Almost overnight it jumped into the front rank of the world's leading industries. Yet it is here to stay—and grow!

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Radio Instructor, $200 to $500 a month.

Radio Draftsmen, $7 to $15 a day.

First Class Ship Operator, $105 a month, all expenses paid.

Second Class Ship Operator, $95 a month, all expenses paid.

Third Class Operator, $85 a month, all expenses paid.

Commercial Land Station Operator, $150 a month and up.

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For that reason Radio needs good men. It is ready to treat them right and pay them well. And for the men who "get in" NOW, the best is none too good.

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